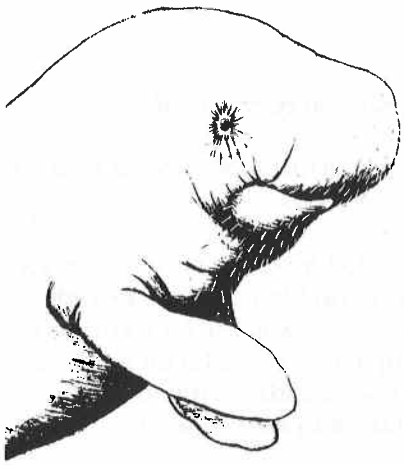


Sam The Sea Cow

(GPN # 83)

Author: Francine Jacobs
Illustrator: Laura Kelley
Publisher: Walker and Company

Science Focused

Program Description: The story of Sam is true. After being freed from a drain pipe, Sam spent thirteen months being cared for at the Seaquarium in Miami, FL. To explore these gentle giants and observe their natural habitat, LeVar travels to Sea World of Florida for an up-close look at manatees. He then assists a rescue crew as they release a manatee they have nursed back to health.

Wild Tales

Key Words: *stories, characteristics of animals*

Concept: *Stories do not always depict characteristics of animals in a realistic manner.*

Much of what we learn about wildlife comes from stories where the characteristics of animals are more human than animal-like.

Materials: A variety of books/stories with animal characters — Aesop's fables, Mother Goose rhymes, picture books, cartoons

1. Read a variety of stories that have animals doing non-animal activities such as talking, using human tools, or wearing clothing.

2. Have students think about the characteristics of the animals in the stories. What kinds of personalities do the animal have — mean (the big bad wolf), funny (Winnie the Pooh), or silly (Donald Duck)? Do stories portray some animals as consistently mean (e.g. wolves), gentle and kind (e.g. deer), or stupid (e.g. most birds)?

3. How might these story images affect the way people think about animals? What problems could this cause? (They might think wolves are mean and that it's OK to kill them. They might think baby animals are cute and cuddly, and unsafely approach them.)

4. Discuss why realistic information about animals is important. Use resource books, wildlife magazines, and/or encyclopedias to compile realistic portraits to compare with the story images.

Teacher Note: Attitudes may vary with students who have had a bad experience with an animal (being frightened by a dog), or who have cultural backgrounds that promote spiritual feelings about wildlife. These differences can be handled sensitively by letting students determine for themselves what is realistic.

Dead Ringer

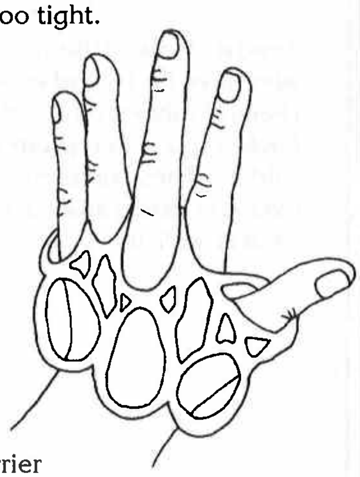
Key Words: *hazard, animal, trash*

Concept: *Human trash items can become hazards for animals.*

Trash can be a hazard for animals. One of the worst is the plastic six-pack rings used on soda pop cans. As animals move about looking for food, they can get these stuck on their nose, neck or around their legs.

Materials: Plastic six-pack carrier, paper, pencils, scissors

1. Slip one loop of a plastic six-pack carrier over a pinky finger, pull the carrier around behind the hand and slip a loop over a thumb and another loop over a finger. The loops should feel snug and limit motion, but not be too tight.



2. Try to get the carrier off without using a free hand or getting help. This is a lot like an animal trying to get a six-pack carrier off its neck or legs.

3. What if the carrier was stuck for good? Are there things that would be hard to do? What effect might the carrier have on an animal's life?

4. Discuss how cutting the plastic loops would make it safer. Trace silhouettes of the carrier so students can decide the best ways to snip the loops, using the smallest number of cuts, to make them safer. (Remind them to consider the very small loops, and that cutting smaller loops often creates large loops.)

Breader Not

Key Words: *nutrients, crop, organ, absorb*

Concept: *Animals have nutritional needs that are filled well by natural foods.*

Feeding stale bread to birds may seem like a good idea, but it can cause problems. Bread provides few nutrients, and when it's in the bird's crop (the small muscular organ that helps break food into smaller pieces) it can absorb too much water, making the bird unable to eat properly.

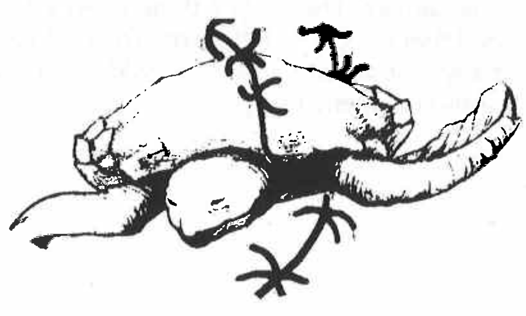
Materials: Bread slices cut into fourths, water, food coloring, measuring cups, clear plastic cups

1. Place a fourth of a slice of bread in a clear plastic cup. Tint a half cup of water with food coloring and pour it into the cup. Observe what happens. As the bread soaks up the water, tilt the cup so the water stays near the bread.

2. Discuss with students that birds, like all animals, have certain nutritional needs. Although bread is made from grain, the processing of the grain into flour eliminates important nutrients for birds.

3. Pour the excess water from the pan into a measuring cup. How much water did the bread soak up? How has the appearance of the bread changed? How might this affect a bird? (If a bird eats a lot of food with little nutrition, it will quit eating when full — but will run out of nutrients too soon.)

4. Discuss appropriate ways to feed birds (see the **Raccoons And Ripe Corn** — *Nice Neighbors* activity).



Worm Wishes

Key Words: *castings, soil, worms*

Concept: *Even small forms of wildlife perform important jobs in the environment.*

Wildlife isn't only large animals living in faraway places — it's also the birds, insects and worms in our backyards. Worms are wildlife that do important work. Check out how they turn organic material into soil by setting up a worm farm.

Materials: Plastic bin with lid (about 18"x 24"x 10"), landscape cloth* (about 18"x 24"), newspaper cut into 1" strips, water, peat moss*, soil, brown leaves, 2 cups calcium carbonate*, black plastic (leaf bag), a few square inches of window screen or fine nylon netting, about a dozen or more healthy worms (dug from a garden, collected on rainy day or purchased from a bait shop — "red wigglers" are best)

**available at garden stores*

1. Put a 2"-3" layer of peat moss in the plastic bin and mix in a cup of calcium carbonate. Cover the mixture with landscape cloth.

2. Mix crumpled brown leaves with an equal amount of peat moss and mix in a cup of calcium carbonate. Put a 3"-5" layer of this mixture in the bin over the landscape cloth.

3. Spread about 4 cups of fresh fruits and vegetables (no citrus, onions or cooked food) around the edge of the bin (on the leaf & peat moss mixture). Create a diagram to show where the food items were placed and post the diagram above the bin.

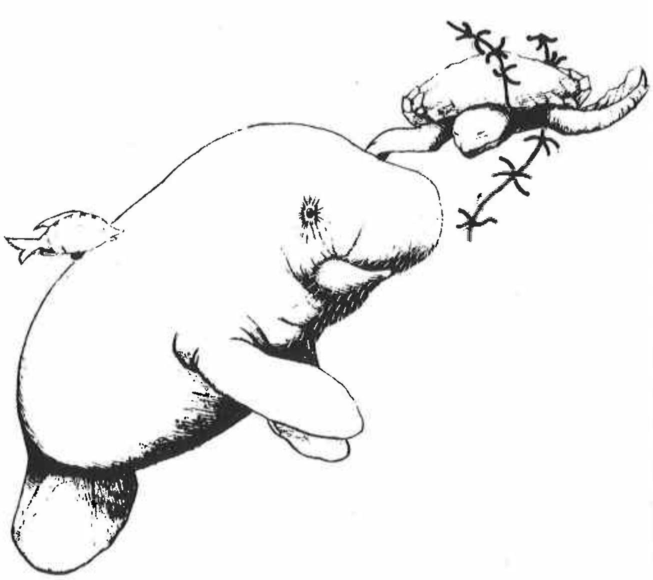
4. Spread 2"-3" of loosely packed, damp strips of newspaper (soaked in water and wrung out) on the leaf & peat moss layer, and top with a layer of brown leaves. The bedding layers above the landscape cloth should be at least 7" deep and no less than 1" from the top of the bin.

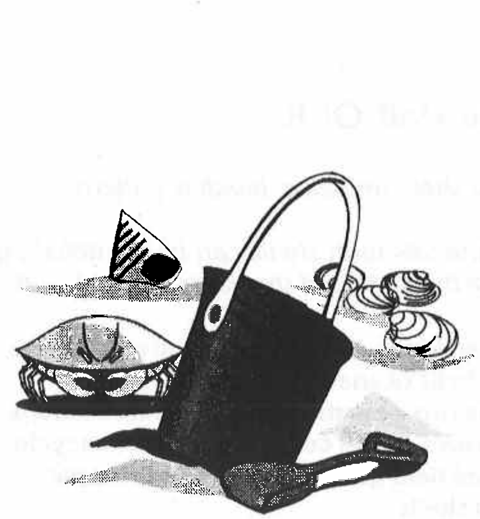
5. Cut five or six 1" holes, for air circulation, in the sides of the bin near the top. Cover the holes with window screen held in place with tape.

6. Put worms in the bin, and loosely cover the contents with black plastic. Put the lid on.

Teacher Note: The worm farm can be kept in the classroom — it doesn't smell or need much care. Every few days lift the lid to check the food (it may take the worms several days to get hungry) and add more food as needed. Check to make sure the newspaper strips haven't dried out.

In a couple of weeks, the food will disappear and the soil in the bin will have changed. There will be small pellets of rich dirt called castings which are excreted by the worms. There may also be small capsules about the size of a match head which are gold to brown in color — these are worm eggs. Remove some of the castings on a regular basis to keep them from being more than half of the bedding volume and replace them with peat moss and leaves mixed together. Replace the newspapers as needed.





Seashore Surprises

(GPN # 88)

Science Focused

Author: Rose Wyler
Illustrator: Steven James Petruccio
Publisher: Silver Burdett Press

Program Description: There's more to the beach than meets the eye! Using the book Seashore Surprises as a resource, LeVar goes beach-combing in southwestern Florida. Two local naturalists assist him by telling him about and showing him plant and animal life at the edge of the sea.

Sea, Hear

Key Words: *hear, white noise, sound, pitch, sound wave, vibrate*

Concept: *Sound waves inside small objects can make white noise that is similar to the sound made by ocean waves.*

Have you ever put a large shell to your ear and heard a rushing surf sound? You might think the shell has trapped the sound of the ocean, but this sound can also be heard in other situations.

Materials: Tumblers and cups (glass, plastic and/or paper)

1. Gather enough tumblers and cups (a variety of sizes) so each student has one.

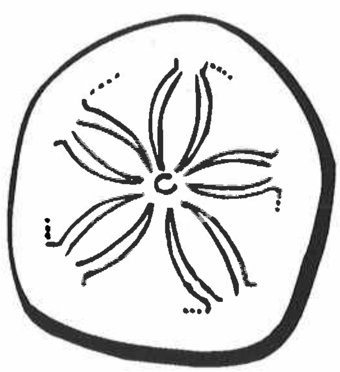
2. Have students hold a tumbler so it covers their ear, then have them move it about an inch away from their ear and listen to the sound.

3. Have them switch to a different size tumbler and repeat the activity. Do the sounds they hear in narrow tumblers differ from the sounds they hear in wider tumblers? How about tall and short tumblers?

4. Relocate the activity to the playground, lunch-room and/or library and have them compare the sounds they hear.

Science Note: The sound heard is called white noise. Just as white light is a mixture of colors, white noise is a mixture of different pitches of sound. At the ocean, waves splash making many different sounds that together create white noise. Students hear a similar mixture of sounds from the tumblers.

Air vibrates as a result of sound waves and wind. These vibrations overlap and mix together to create white noise in the cups. Although the vibrations are the same, some cups will have a lower or higher pitch than others. Generally, taller and wider tumblers sound lower than narrower and shorter tumblers. The sound is also influenced by what the cup is made of.



Where Have All The Shells Gone?

Key Words: *shells*

Concept: *Shells are chipped and broken into pieces as ocean waves cause them to tumble against hard objects.*

For millions of years shells have washed up on beaches. But those old shells aren't there and the new ones are usually chipped and cracked. What happens to them?

Materials: Pasta shells of various sizes (large mixed with small), coffee cans with lids, fist-sized rocks, tape, dark paper or plastic

1. Put a mixture of sizes of shell pasta in a coffee can after putting aside several whole pasta shells for later comparison. Take note of the condition of the pasta shells.

2. Place several fist-sized rocks in the can and put the lid on. Use tape to hold the lid securely on the can. Then carefully shake the can up and down like the rolling and crashing of waves at a beach.

3. After several minutes of shaking, remove the lid and pour the pasta and rocks onto a piece of dark paper or plastic. Compare the pasta from the can with the original sample. *(The pasta shells cracked and chipped as they rolled against each other and against the rocks. At the beach, shells break into smaller and smaller pieces and become sand.)*

Science Note: The unchipped shells sold in shops are primarily harvested from live animals. The populations of some shell animals have been declining due in part to this practice. It's best for the environment and the animals to collect imperfect shells from the beach, rather than buy perfect ones in a shop.

Only The Half Of It

Key Words: *shell, univalve, bivalve, pattern*

Concept: *Animals with shells can be identified by the shape of the shell and the pattern found on it.*

There are two kinds of shells — univalves, the one-piece shells of snails and whelks; and bivalves, the two-part shells of clams and scallops. Create a bivalve model collection. Use an encyclopedia or shell field guide for the colors and patterns of real shells.

Materials: 4" heavy paper squares (construction paper or paper cut from grocery bags), tape or glue, crayons and colored pencils

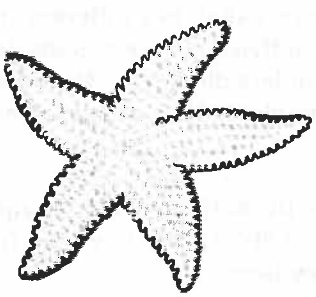
1. Hold two paper squares together and cut two oblong shell shapes. With the two shapes still together, cut a 1/2" slit into the middle from the center of one of the straightest edges.

2. Decorate the bivalves. To simulate ridges, accordion-fold each half.

3. Take one side of the bivalve shell shapes and form it into a shallow cone (like a clam shell) by sliding the paper on one side of the slit over the other so there is some overlap. Use tape or glue to hold the overlapping paper in place.

4. Repeat this with the second shape, making sure the overlap is about the same. Check to see that the two shells fit together (like a closed clam) before taping the second shape.

5. Connect the two shells by making a tape hinge at the points where the slits were cut.



Twists Sand Turns

Key Words: *properties, sand particles, patterns*

Concept: *Properties of materials interact with objects to make interesting patterns.*

Sand has interesting properties. Like liquid it takes the shape of a container; like a solid it can scratch hard surfaces. When it's wet, it holds its shape because water is attracted to sand particles and they attract each other. Use "sand stylers" to create sand patterns and explore the properties of sand.

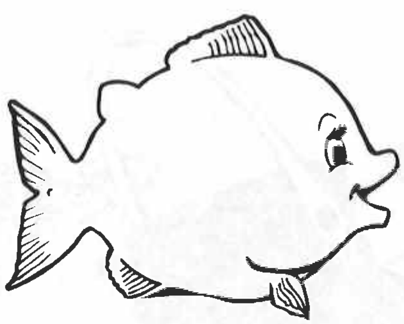
Materials: Wet sand, rectangular cardboard (about 3" x 10"), scissors

1. Create sand stylers by cutting a pattern of teeth into the long edge of a light cardboard strip (e.g. from a cereal box). Patterns can be a mix or match of zig-zag teeth, waves, square teeth, sharp teeth, etc.

2. Predict what pattern each styler will make when it is dragged over the surface of wet sand. What if it is dragged in a circle, or dragged to the side and forward at the same time?

3. Drag the styler in these ways across a tray of wet sand. Were the predictions correct?

Extension: Students can record the patterns they make in the sand on paper and trade them with a partner. The partner can then work to duplicate the styler that drew the pattern. Ask them to share what clues were most helpful for duplicating the patterns.



Sand Skyscrapers

Key Words: *measurement, sand, building*

Concept: *Changing variables will affect the height of a tower that can be built with sand.*

There are sand castles and skyscrapers — how about a sand skyscraper? Explore how tall a tower of sand can stand, and what's the best way to build it.

Materials: Wet sand, water, plastic sheet/plastic leaf bags or sand box, large coffee cans, sand forms (various containers that are smaller than the coffee cans, such as cups, tumblers, and empty milk cartons), measuring stick

1. In an outside area, fill a large coffee can with wet sand — one for each group — and use this as a base for each sand skyscraper. (All bases should be the same.)

2. Have groups develop strategies and then build a sand skyscraper on this base using wet sand and sand forms.

3. Determine the tallest by measuring each. Then discuss what worked and what didn't. What are the qualities of the tallest sand skyscrapers? Is it better to have straight sides or tapering sides, to use larger or smaller sand forms, to use wet sand or barely damp sand? What advice would students give others who are just beginning this project?

(See *Deep Breath* next page)

Deep Breath

Key Words: *air, breathe, space, grains, sand*

Concept: *Animals fill their needs where they live.*

Many kinds of animals live in sand, especially at the seashore. Explore where these animals find air to breathe.

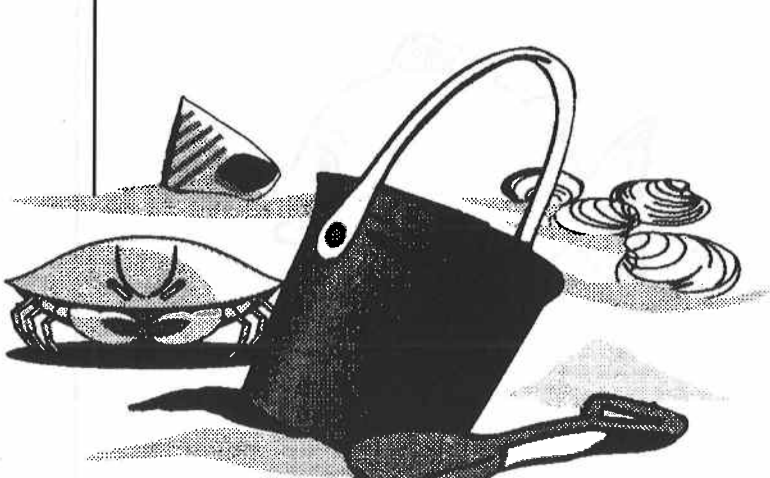
Materials: Clear plastic cups, dry sand, plastic wrap, water, rubber bands, bowls or buckets, measuring cups (optional)

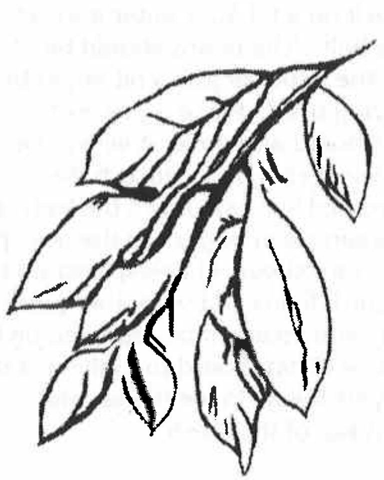
1. Fill a cup with dry sand. Examine the cup to make sure it is full.

2. Fill a measuring cup with water and discuss how much water the sand-filled cup will hold. Pour the water in until the cup can hold no more. Discuss what happened to the water.

3. Fill another cup with dry sand and cover it with plastic wrap held in place with a rubber band. Poke two small holes (1/8" - 1/4") in the plastic wrap — one in the center and one near the edge.

4. Immerse the sand-filled cup in a bowl of water. What comes out? Where does it come from? Some animals breathe the air in the spaces between the grains of sand. (Other animals breathe through holes they make leading to the surface of the sand.)





The Shaman's Apprentice: A Tale Of The Amazon Rain Forest

(GPN # 136)

Science Focused

Author: Lynne Cherry and Mark J. Plotkin
Publisher: Harcourt Brace

Program Description: LeVar and author/enthobotanist Mark Plotkin visit the Tirio village and meet Kamanya, the boy from the book, who has become a shaman. They learn how the rainforest remains a vital source for modern medicines as they join the shaman in a search for healing plant, and experience daily life of the Tirio people.

Not the Same Mold Story

Key Words: mold, fungus, fungicide

Concept: Plants are useful to people in many ways.

Like plants found in the rainforest, some of the foods found in your local grocery store are useful in unexpected ways. The spice called "cloves" is a rainforest plant that is used in cooking, but it also has other uses. Cloves can be used to kill several kinds of fungi (i.e. it is a *fungicide*). This can be tested on bread mold – a common fungus.

Materials: Whole cloves, ground cloves, liquid dish soap, 2 pie pans, plastic wrap or plastic bags.

1. Have students examine whole cloves. Explain that cloves is a spice that comes from a rainforest plant and that it's used both ground or whole in cooking.

2. Mix ½ teaspoon of ground cloves with 2 cups of water. Add 3-4 drops of liquid soap and mix gently (don't make suds) so the oil in the cloves will mix with the water. Let the mixture stand for awhile at room temperature.

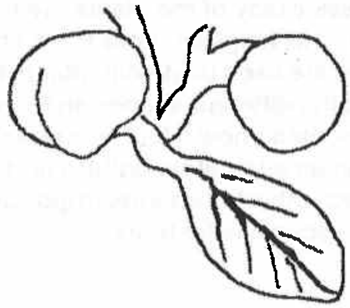
3. Put a slice of bread in each pan. In one pan, pour ½ cup of the mixture over the bread so it is soaked and then label it. In the other pan, do the same thing using a ½ cup of water (don't forget to label it). If the bread begins to dry out, add a little more liquid.

4. Treat both of these the same (i.e. store them in the same place, add the same amount of water or clove mixture to each appropriate pan, etc.), so that the only difference is that one has cloves and the other does not.

5. Watch the bread for several days. What differences can be observed? (*Although both slices of bread will mold over time, the mold will grow more slowly on the bread with the cloves.*)

Extension: Test the fungicidal properties of other spices and by doing this activity again and substituting another spice for cloves. It may be necessary to use a blender to mix some spices with water.

Science Notes: Clove oil can be purchased at some specialty shops; it is a potent anti-fungal agent. Garlic also kills fungi (and bacteria); it has several sulfur-based compounds in it and sulfur has long been recognized as a strong antibiotic.



Start the Presses

Key Words: plant, leaf, herbarium

Concept: Plants can be compared by making observations of their leaves.

One of the most important things that Mark Plotkin has done is collect samples of rainforest plants so they can be identified and studied. He pressed collected leaves and flowers between layers of paper – actually newspaper – to preserve them. A collection of labeled specimen which is used to compare and study plant properties is called a herbarium. You can make an herbarium of school yard or neighborhood plants.

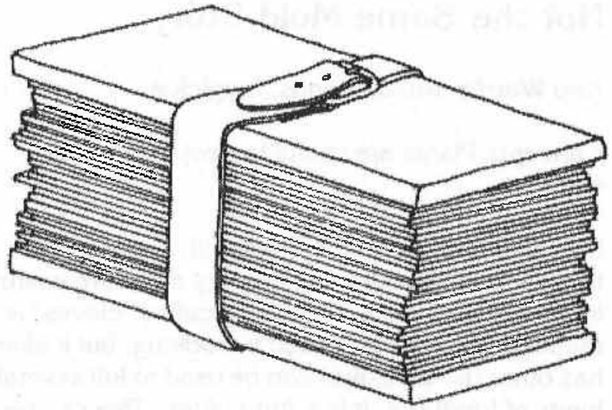
Materials: Two small boards, an old belt, clean paper (e.g. newsprint), discarded newspapers, cardboard

1. Before beginning the activity, scout around the collection area to be sure it is free of harmful plants (e.g. poison ivy). Also check with the grounds people to see if any plants, such as freshly planted ornamentals, should not have leaves removed from them.

2. Collect several leaves from a plant and place them on a clean sheet of paper. Trace around each leaf – which will be a helpful cue for returning the leaves if moved for study. On the paper, also write a description of the leaves, the plant, its surroundings, the location, the date, the name of the collector, and other notes that might be useful. Put another sheet of paper on top of the leaves so they are sandwiched between clean pages.

3. Collect leaves from several types of plants and repeat the above procedure. Leaves can be collected, described, and compared even if you do not know the names of the plants (remember that in a rainforest, many of the plants are new to the collectors.) This helps students learn about features that are used to identify plants including recognizing the different shapes and sizes of leaves. Describing how a leaf was attached to a plant (e.g. in an alternating pattern or directly opposite each other) is another important identifying feature, especially for trees.

4. Place an old belt on a table. Center a wooden board on top the belt. The board should be about the same size as the paper or just a bit larger than the cardboard being used. Place a piece of cardboard on the board and cover it with several sheets of newspaper (enough to absorb the moisture from pressed leaves). Place the leaf, still sandwiched between clean pages, on the newspaper. Put several more sheets of newspaper on top of it (for absorption), followed by another piece of cardboard. This sequence can be repeated on top of the second piece of cardboard to make a stack that is several layers thick. Place the second wooden board on top of the stack.



5. Loop the belt around the stack and pull it tight. Fasten it so that it holds the stack snuggly. You may have to punch a new hole in the belt, or just tape the buckle in place. Leave this for several days.

6. After several days, unfasten the belt and look at the leaves. They should be well preserved. If the stack is left for a long time, the leaves will dry and will hold their detail, however they should be handled with great care as they will become fragile.

Extension: Flowers can be pressed in this same manner. Some flowers press better than others.

There's Nothing Like Being Different

Key Words: diversity, biodiversity, monoculture, species

Concept: Within a species, different individuals have different traits, some of which affect their survival.

Rainforests are home to a wide array of plants and animals. One of the most important aspects of the work being done by Mark Plotkin and others who study rainforests is that they are cataloging and preserving species found nowhere else. Even within a single species there are many different strains, with slight variations from one strain to another. This vast diversity of living things – called *biodiversity* – is very important because diseases that affect some kinds of living things don't affect others. For example, a type of tree might be badly harmed by a disease but there might be a few individuals that are different from the rest and are therefore not affected. Those unaffected plants help the species stay alive even if the disease is widespread. This activity helps students understand the importance of the biodiversity.

Materials: 3x5 cards (one for every students)

1. Create a card for each participant by writing a letter and a number on each. Use the letters A-E, making sure there are several cards with each letter, and the numbers 1 or 2, making sure there are about an equal number of each on the cards. Fold each card in half so the number and letter are on the inside.

2. Give each student a card and ask them to keep the card folded with the letters and numbers concealed. They shouldn't show their letter or number to anyone else.

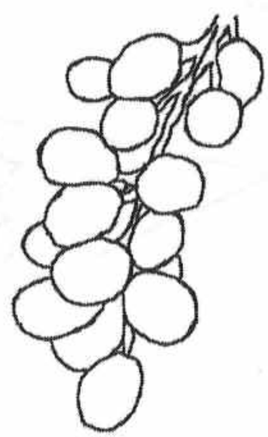
3. Have them carry their cards as they play a game of freeze tag. Assign someone to be "it." When students are tagged, they should stop running and stand still. You should stop the game when about half of the students have been tagged.

4. After you stop the game, ask the person who is "it" to read the letter on their card, and ask those who have been tagged look at their cards and raise their hand if they have the same letter. Count and document how many people that is. Explain that the person who was "it" represented a disease-carrying organism, but only those with the same letter are susceptible to the disease. Everyone else is immune.

5. Repeat the tag game. This time, when you stop the game, have the tagged people with the same number as "it" raise their hands. Those represent the people who are susceptible to the disease, while the people with the other number are immune.

6. Compare the numbers of the two games of tag. Help the students understand that the letters represent a situation in which there is more biodiversity. When there is more variation, there was more chance of being immune. The numbers represent a situation in which there is less biodiversity, so there is less chance of being immune. Ask students what would happen if there had been only one letter or number used in one of the games of tag.

Science Note: The opposite of biodiversity is *monoculture*—the presence of a single strain or kind of living thing. A grass lawn is a good example of monoculture where only one kind of plant is used throughout the lawn. Modern American farmers tend to use a single strain or kind of plant in a given field, which is another example of monoculture. The problems of a monoculture were seen in the mid-nineteenth century during the Irish potato famine. At that time, most Irish farmers grew a single hybrid of potato. When a fungus attacked that strain, most of the crops in the country were ruined, causing the famine. Although potatoes are not rainforest plants (they were developed in the high elevations of the Andes in Peru) this historical event demonstrates the importance of maintaining biodiversity.



Leaf Mosaics

Key Words: climate, microclimate, leaf mosaic

Concept: All living things affect the environment in which they live, such as when plants affect the microclimate of the area around where they grow.

All plants change the conditions around them as they grow, especially in terms of temperature, humidity, and light. Scientists refer to this as a *microclimate* effect. While the climate of a place may be very hot and bright, the microclimate under a plant in that place may be much cooler and darker. One of the characteristics of a rainforest is the shadowy darkness found at the forest floor – a microclimate created by the plants. In this activity students explore what is called the "leaf mosaic" – the pattern of leaves on the branches of trees – and consider how it can affect the microclimate in the forest.

Materials: Leaf cutouts (about 5 per group of 2-3 students) made from 3x5 cards or real leaves of about the same shape and size (oak or maple work well for this), paper (about 3 pages per group).

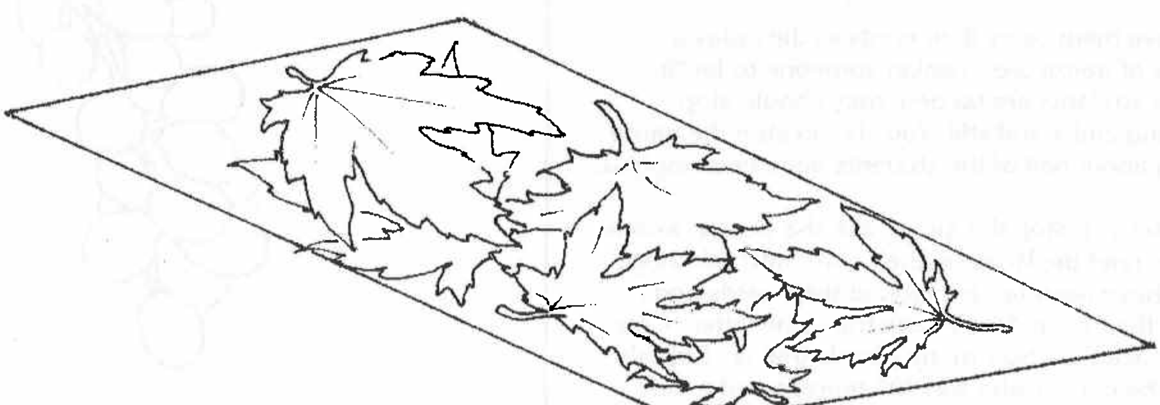
1. If possible, on a fairly calm and sunny day, take students outside under a leafy tree. Have them look for spots of sunlight on the ground under the tree. How much of the ground seems to be shaded? How much has sunlight on it? What does the breeze do to the sunlight?

2. Give each group of 2-3 students 5 leaf cutouts and several pieces of paper. Have them place one leaf cutout on the paper. If this leaf were on a tree, how much of the ground would be shaded by this leaf?

3. Have them add a second leaf to the page, arranging the leaves on the paper so that they cover as much of the paper as possible. (They may overlap the leaves and the leaves can hang off the edge of the paper.) Have them add another, and another, trying to cover as much of the paper as possible. Students will find that it is very hard to cover all of the paper with the leaves. It would take a lot of leaves to cover every spot of paper. This shows that, although there are lots of leaves, some of which overlap each other, there are still spaces for the sunlight to get through.

4. Go back outside to the tree that was observed in step 1 and have the students look up from below the tree (Caution! Students should not look directly toward the sun.) Have them notice how many of the leaves have shadows of other leaves on them.

Extension: Use graph paper so students can more accurately estimate the area covered by the leaves.



No Need For Seed

Key Words: reproduction, vegetative reproduction

Concept: Plant parts can sometimes grow into whole, new plants.

Rainforest plants seem to have an ideal place to live with plenty of water and sunlight. There are challenges, however. The soil is poor because the rain washes away nutrients easily. As a result of the poor soil and plentiful rainfall, roots do not grow very deep. That means that trees can be uprooted easily by the wind, crashing to the ground along with vines and other plants that grow on them. Animals also tear up plants as they climb around looking for food and make nests. If this kind of damage always caused plants to die, it would be very destructive. However, many rainforest plants have adapted to this in ways that actually add to the lushness of the rainforest. That's because some plants can begin to grow or reproduce from pieces of plants that have been damaged by weather, animals or other forces. This kind of reproduction is called *vegetative* reproduction which is different from *sexual reproduction* which needs seeds and requires two parent plants. In this activity, students will see how plants can grow from pieces of other plants.

1. Obtain a heart-leaf philodendron (Philodendron cordatum) plant. These are common philodendrons available at many plant stores. They have heart-shaped leaves that are 1-3 inches across. (Other varieties will work, too. Ask your florist.) You'll want to start with a plant that has some long vines. Have the students examine the plant.

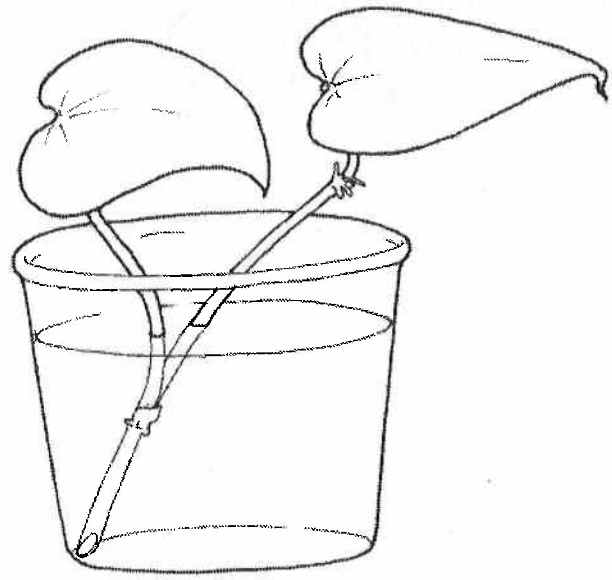
2. Trim one or more vines off the plant. Cut the trimmed vines into pieces. Each piece should have at least two joints with leaves attached. Pay attention to which side of the piece was closest to the plant. This will be the "bottom" of the piece.

3. Have students examine, draw, and describe a piece of philodendron. Ask them to pay special attention to the joints at the base of the leaf, recording anything they see there. (Often they'll see small knobs. These will become roots.)

4. Put the bottom of the piece of philodendron in a cup of water (adding a few pieces of charcoal to the water helps keep the plant healthy.) Water will have to be added over time to keep it at about the same level.

5. Over several weeks, have students observe the pieces of plant and compare what they see to what the piece looked like at the outset of the activity. Over time, the pieces will grow new roots from the joints near the leaves.

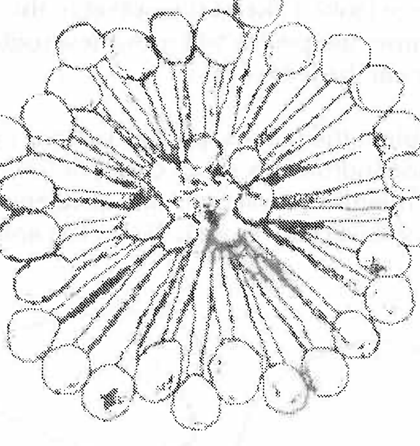
6. To plant the pieces, put the bottom of the piece of philodendron in a small cup, pot, jar or bowl with a mixture of soil and sand (use enough sand so the soil will stay loose). Water the soil well.

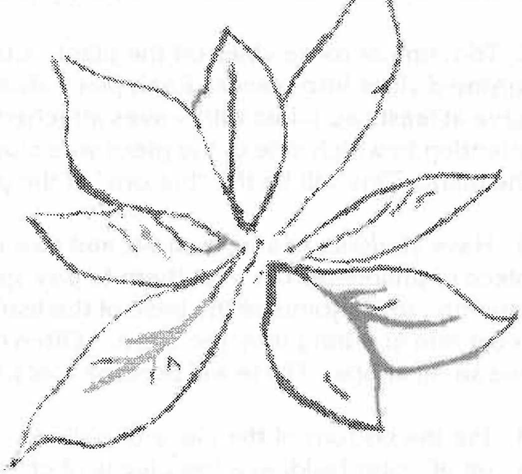


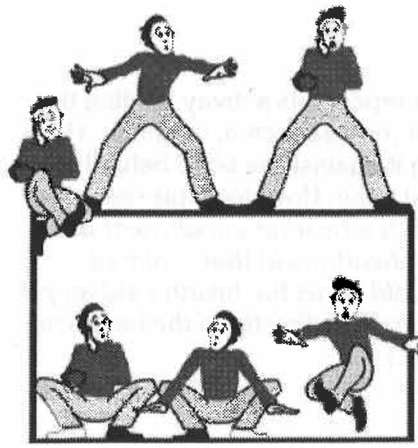
Extension: Try this with potatoes (use an unpeeled piece with at least one eye) or carrots (use the tops with quite a bit of carrot still attached).

Caution! Philodendrons are poisonous. Have students wash their hands and work areas. Tell them not to eat any part of the plant.

Science Note: Philodendrons have been found to remove certain chemicals from the air – especially formaldehyde.







Silent Lotus

(GPN # 95)

Author: Jeanne M. Lee
Publisher: Farrar, Straus, & Giroux

Science Connected

Program Description: LeVar explores the vast and expressive world of non-verbal communication by watching mimes and talking with people who communicate using sign language.

Vibration Sensation

Key Words: sound, vibrations, sound waves.

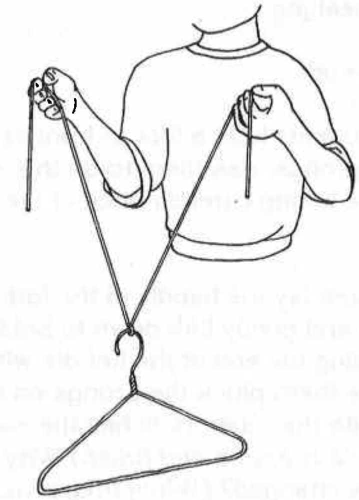
Concept: We can feel sound waves as vibrations.

Our ears are very complex. They receive sound waves traveling through the air and convert them to electrical impulses, which our brain interprets. Sound waves are compressions in air caused by vibrating objects. A person who is deaf may not be able to hear sounds, but they can still perceive the vibrations that cause sound waves. In this episode the dancers who were deaf danced to the vibrations they felt from the music. These vibrations are the same ones that hearing people's ears and brains translate into sound.

Materials: Wire clothes hanger, string or yarn, scissors, metal tablespoon.

1. Students work in pairs and take turns experiencing the vibrations. First tie two pieces of string (each about 3 feet long) to the hook at the top of a clothes hanger.

2. Have students drape the strings over their fingertips and hold them out so that the hanger is in mid-air while their partners gently tap the hanger several times with a spoon. Ask students to pay close attention to the sound they hear. *(It will be a dull tapping sound.)* Also see if they feel subtle vibrations through the strings on their fingertips as the hanger is tapped.



3. Then have students lean forward and wrap a string over and behind each ear, holding the ends of the strings there while their partners tap the hanger with a spoon. How has the sound changed? (*The sound will be louder and much fuller, similar to the sound of a bell. They hear more sound with the strings touching their head, plus they can feel the vibrations in the strings.*)

It's All In Your Head

Key Words: *sound, sound waves, vibrations*

Concept: *Sound waves can travel to your ear through the bones in your skull.*

We usually think of sound waves as traveling through the air to our ears; however sound waves, which are vibrations, can also travel to your ears through the bones in your head. This is one reason why your own voice may sound different when you hear it on a recording. When you listen to a recording of your voice, you don't hear the inner vibrations that you hear when you are actually speaking.

Materials: Fork.

1. Have students hold a fork in front of them and pluck the prongs. Ask them to do this several times while taking careful notice of the sound they hear.

2. Have them lay the handle of the fork across their teeth and gently bite down to hold it in place. While holding the end of the handle with one hand, have them pluck the prongs on the end of the fork with the other. How has the sound changed? (*It is louder and fuller.*) Why do they think it has changed? (*When they plucked the prongs before, the sound waves traveled out through the air in all directions and only a few of the vibrations made it to their ears. With the fork held in their teeth they can hear the sound more directly because it travels through the bones in their jaw and skull as well as to their ears.*)

3. Have students repeat this activity holding the fork against their forehead, chin, or cheek. Have them try holding it against the bone behind their ear—the mastoid bone. How does this compare? (*Some people with a hearing impairment use a bone-conduction hearing aid that is placed against the mastoid bone; the hearing aid amplifies sounds that travels directly to the inner ear through the bone.*)

Science Focused

Space Case

(GPN # 31)

Author: Edward Marshall
Illustrator: James Marshall
Publisher: Dial

Program Description: In this program LeVar sends a special invitation to all aliens to visit Earth and entices them with a sample of Earth's wonders. Visit the Lick Observatory on Mount Hamilton in California where astronomers use a gigantic telescope to watch the skies. Then travel to Arecibo, Puerto Rico, to see the world's largest radio-telescope which scientists use to listen to space.

Balloon Rockets

Key Words: *rocket, force, third law of motion*

Concept: *Gases that are pushed out the back of a rocket push the rocket forward with an equal force.*

A rocket exerts a force on gases by pushing them out the back of its engines. The gases then exert an equally strong force in the opposite direction, causing the rocket to move forward. This is an application of Newton's third law (of motion).

Materials: Balloons in a variety of sizes, paper, tape, scissors, quart-sized milk carton, water, tub for catching water, monofilament fishing line.

1. This force can be demonstrated easily with balloons. When the opening of an air-filled balloon is released, the balloon forces the gases back and the gases force the balloon forward.

2. Students can experiment with guiding flight by adding rocket features (fins, nose cones, etc.) to the air-filled balloons.

3. To further explore this law of motion, suspend a milk carton—holes punched on the lower right of each side—from fishing line (put something under it to catch the water). As the carton is filled with water, the water pushes out of the off-centered holes and the force causes the carton to spin.

Now You See It, Now You Don't

Key Words: *adaptation, camouflage, environment*

Concept: *Organisms are adapted to their environment, which can include being camouflaged to blend in to their surroundings.*

Beings that look alien to us are often examples of organisms that have adapted to their environment. Shape and color are two features of adaptation. Experiment with these facets of adaptation by creating "creatures" that blend into the natural environment.

Materials: Potatoes, scissors, glue, variety of colored paper, toothpicks, paper clips, pipe cleaners, masking tape, paint brushes, paints, natural materials: sand, leaves, grass, etc.

1. Begin by discussing examples of camouflage adaptation, encouraging students to think about colors, textures and shapes that will work well in different situations. Then visit the school yard to assess camouflage needs and to collect natural materials for this project.

2. Provide each pair of students with a potato to camouflage. When the "creatures" are completed, have them describe how their creations will blend into their surroundings.

3. Divide the class into two groups. Have the first group hide their creations, then give group two three minutes to find them.

4. Repeat this, reversing group roles.

Sending Mail To Space

Key Words: *binary code, signals*

Concept: *Simple binary codes are used to send signals to space in the hope of communication with other intelligent life.*

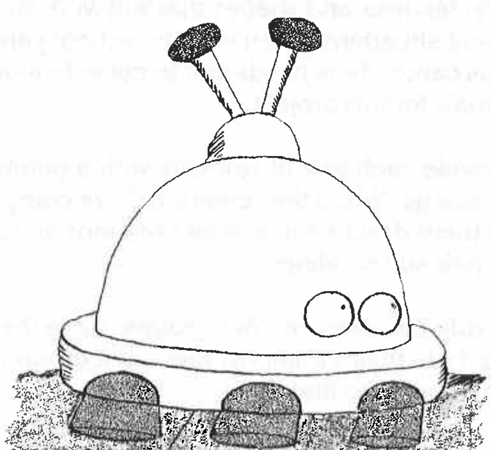
Many scientists think that we will not know there is other intelligent life in space until they contact us. In an effort to invite contact, Earth scientists have made many attempts to send messages and to translate space signals using binary code. This code is very simple—it uses two indicators such as buzz and beep tones or one (1) or zero (0) symbols for on and off.

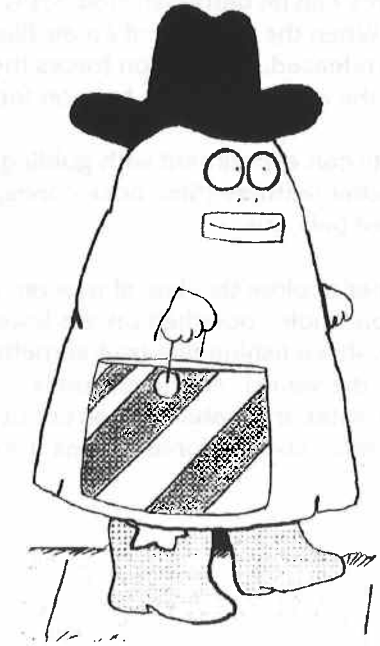
Materials: Markers or crayons, graph paper (students must have sheets of identical size and number of squares).

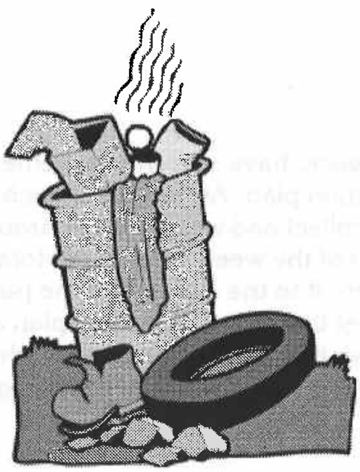
1. Discuss the kind of information that could be sent to outer space using simple pictures. Ask students to design a picture message using one color. Then have them transfer the picture message to graph paper using one color to fill in the appropriate squares. The colored squares and uncolored squares should combine to shape the picture message.

2. To translate the picture into binary code, the students begin the encoding at the upper left of the picture using a number "1" to represent colored squares and a zero "0" for uncolored squares. Continue this by starting a new line of code for each line of graph paper.

3. Have students decode each other's messages (which will be lines of ones and zeros) by reversing the process.







Stay Away From The Junkyard!

(GPN # 57)

Author: Tricia Tusa

Publisher: Simon & Schuster

Science Connected

Program Description: As LeVar holds his own garage sale he explores how one person's junk might be another person's treasure. Michael Ives is an artist who does just that—collects "junk" and transforms it into fun and fascinating artwork.

Gotta Lotta Rot

Key Words: *garbage, decomposition*

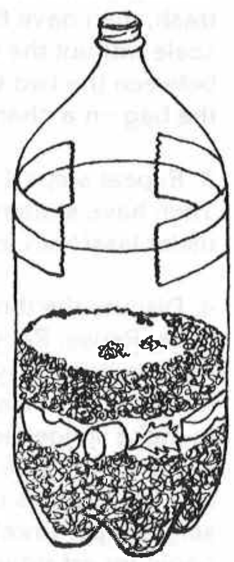
Concept: *Organic materials are naturally recycled into soil.*

Many items in a junkyard can be recycled. They can be changed into works of art, new products, or just repaired and used again. The natural environment is the ultimate recycling center. Water, air, soil, and plants and animals are all naturally recycled. Unfortunately, this natural system doesn't work with many materials made by people. Items like plastic milk cartons and Styrofoam cups can take hundreds or even thousands of years to bio-degrade in a landfill. Even natural items like orange peels take a lot longer to rot than we think. Experiment to see which items of garbage decay fairly quickly and which do not.

Materials: Several 2-liter soda bottles that have been cleaned and the labels removed, large spoons, soil, water, newspapers, writing paper, pencils, small samples of garbage to be decomposed including paper, plastic, cardboard, Styrofoam, and food scraps (not dairy or meat).

1. Using a pair of large scissors, cut the top portion off of the soda bottles. Remove and discard the lids.

2. Have small groups of students each fill the bottom portion of a soda bottle with about 2" of soil. Next have them place a layer of 6 or 7 small (about an inch or two in diameter) samples of lunch leftovers (no meat or dairy, it is too smelly) or other small items of garbage in the bottle. Have them place as many of the items as they can against the sides of the bottle so they can be seen as they rot. Then have them make a list of the samples and draw a diagram showing where they placed each. Have students cover the samples with another layer of soil and then dampen the soil by sprinkling water in the bottle.



3. Refit the top portion of the bottle to the bottom portion and tape the two together. Set the bottles in a cool, dark location. Ask students to predict which of the samples will be completely decomposed in four weeks and have them mark their predictions on their list.

4. Once or twice a week for the next four weeks, have students check their bottles. Ask them to describe the appearance of the contents of the bottle. How can they tell if any of the samples are rotting? Have students record their observations in a log. Remind them to dampen the soil if it appears dry.

5. After four weeks, have students dump the contents of their bottle out onto newspaper. Have them use a spoon to examine the samples and record the condition of each sample in their logs.

6. Discuss the findings and rank the samples from those that showed the greatest signs of decay down to the samples that showed the least. Ask students to identify characteristics of those that decayed quickly and those that did not.

Stay Away From The Trash Can

Key Words: garbage reduction, recycling, reuse, measurement, weight

Concept: The amount of garbage thrown away each day can be reduced.

Learn about trash by taking a closer look at the classroom trash can.

Materials: Large trash bags, plastic gloves, bathroom scale, trash can, chart paper, markers.

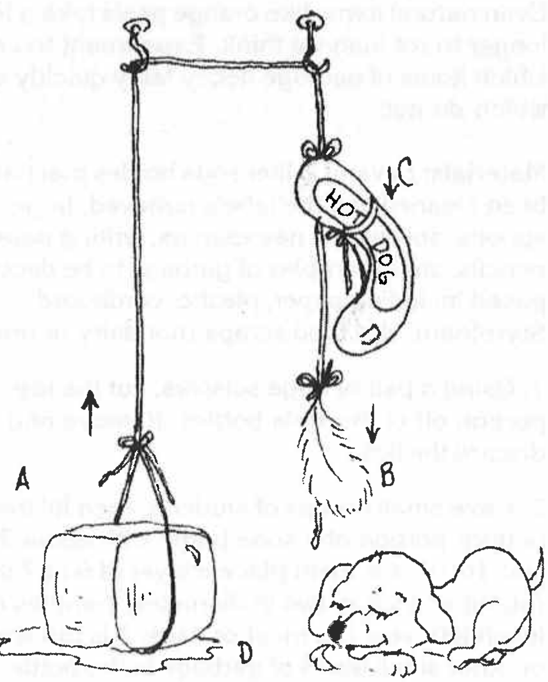
1. At the end of the school day have students collect the trash from their classroom in a large plastic trash bag(s).

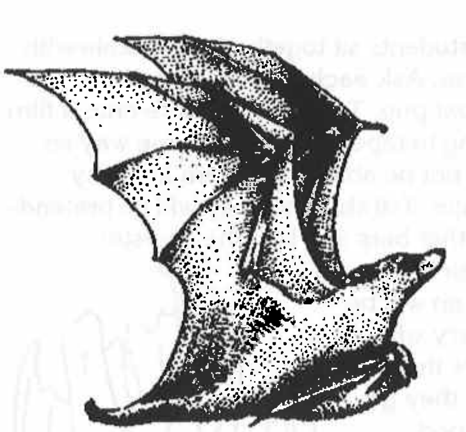
2. Have students weigh the trash using a bathroom scale. One way to do this is to have a student stand on the scale holding the bag of trash, then have the same student stand on the scale without the bag. Subtract the difference between the two weights and record the weight of the bag on a chart.

3. Repeat steps 1 and 2 each day for a week. Then have students add up the total weight of their classroom trash for the entire week.

4. Discuss the three R's of waste reduction (Reduce, Reuse, Recycle), then have students brainstorm a list of ways that they can decrease the weight of their classroom trash. Encourage them to make suggestions that they can do themselves and are workable over a long period of time (e.g. using both sides of a sheet of paper, using only single paper towels, collecting small scraps of paper for art projects). Decide on a garbage reduction plan by choosing the brainstorming ideas they can start doing right away. Make a separate list of ideas that will take some additional planning or preparation to begin but are worth pursuing (e.g. taking paper to a recycling center). Help them set a reasonable goal for the amount of trash they think they can decrease the next week.

5. During the next week, have students implement their garbage reduction plan. At the end of each day have students collect and weigh the classroom garbage. At the end of the week, add up the total amount and compare it to the amount for the past week. If students met their goal, help them plan a trashless celebration. If not, help them review what might have happened and assist them in revising their plan. Then try it again.





Stellaluna

(GPN #108)

Author: Janell Cannon
Publisher: Harcourt Brace

Program Description: After Stellaluna, a baby bat in the feature book for this episode, falls head first into a bird's nest, she discovers that there are some important differences between bats and birds. In this program LeVar makes some discoveries of his own about the mysterious and fascinating world of bats and other nocturnal animals. Then before settling down to a night of restful sleep, LeVar leads us on an exploration of slumber and dreams.

Atmosphere Of Togetherness

Key Words: *acids, bases, indicator, ammonia*

Concept: *Ammonia, including ammonia gas created from bat droppings, is a base.*

Ammonia gas created from bat droppings, or guano, is a strong base. Strong bases, like strong acids, can severely burn skin and lungs. This is why the scientist on this episode, Dr. Merlin Tuttle, had to wear a gas mask while in the cave. Although it doesn't make for good air for people, bat droppings are used as fertilizers which do make for healthy plants.

You can find some common bases in your home, such as ammonia, using red cabbage juice as an acid and base indicator (or pH indicator). Cabbage juice, like litmus paper which is a pH indicator made from a lichen, will turn blue when mixed with a base. If you mix it with a strong base, the cabbage juice will turn green, or if very strong, even yellow. If you mix it with an acid, it will turn red. If mixed with a substance that is neutral (neither an acid, nor a base), the cabbage juice will not change color.

Materials: red cabbage, pan, stove, water, chart paper, clear plastic cups, spoons, vinegar, lemon juice, household ammonia, baking soda.

1. Boil 1 cup of chopped red cabbage in 2 cups of water for 30 minutes to create a violet-blue indicator liquid. (Increase the amounts if you are planning to conduct the activity with several groups of students.) Strain this liquid off into a bowl and let it cool. If necessary, it can be stored in a refrigerator for a day or two.

2. Make three columns on a sheet of chart paper. At the top of the first column write "Base-Blue, Green, or Yellow". At the top of the middle column write "Neutral-No color change." At the top of the last column write "Acid-Red."

3. Show students the indicator liquid and explain how it was made and how it will change colors when mixed with things that are either an acid or a base. Discuss the chart and the color changes for bases and acids.

4. Pour about 1/4 cup of the indicator liquid into a clear plastic cup. Have students predict what will happen when you add ammonia (a base) to the indicator. (It will turn blue, green, or yellow depending on the amount and strength of the ammonia.) Add about a teaspoon of household ammonia and stir gently. Write the word ammonia on the chart under the word base.

5. Each time using a clean cup and spoon, repeat Step 4, once adding a teaspoon of lemon juice which is an acid (the indicator will turn red) and again using plain water which is neither an acid nor a base (the indicator will not change). Record each on the chart.

6. Have groups of students test for bases and acids by giving them the following items:
- a cup with 1 teaspoon of baking soda mixed with 3 tablespoons of water
- a cup with 1 teaspoon of vinegar mixed with 3 tablespoons of water
- 3 cups, each with 1/4 cup of the indicator liquid (one will be used for comparison).

(Continued next page)

Atmosphere Of Togetherness *(Continued)*

Ask students to predict what will happen when they combine the baking soda and the indicator. Then have them mix them together. Discuss and record the results (baking soda is a weak base and will turn the indicator blue). Next, have them predict and then combine the vinegar and the indicator. Discuss and record the results. (Vinegar is an acid and will turn the indicator red.) If students have trouble seeing the color differences, have them compare the changed indicator to the liquid in the third cup.

Extension: Have students check other common household powders or liquids. Be sure to select only items that are safe for students to handle.

One In A Thousand

Key Words: *bats, senses, memory*

Concept: *Mother bats use their sense of smell to help identify their babies.*

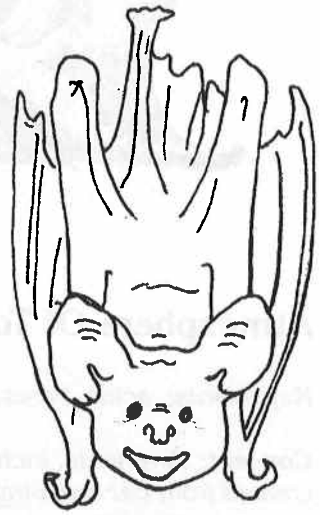
Stellaluna's mother used her sense of smell to identify Stellaluna upon their reunion. Many bats leave their babies, called pups, in a bat nursery (a particular part of the cave or building that the bats are living in) when they go out hunting for food. Because so many bats live together, a mother bat often has to find her pup among hundreds or thousands of other baby bats when she returns. She uses her keen sense of smell along with memory of position and hearing to find her own special baby.

Materials: 6 cotton balls, a few drops each of 6 scented extracts and oils (such as oil of cinnamon, oil of cloves, extract of vanilla, extract of mint, extract of lemon, witch hazel) 6 film canisters with lids, 6 copies of bat pups made from the pattern, tape, scissors, an egg carton, 6 blindfolds.

1. Place a cotton ball, scented with a different extract or oil in each of 6 canisters. Put the lids on the canisters.

2. Take the top off an egg carton and tape the carton down on a table top.

3. Have six students sit together at the table with the egg carton. Ask each student to color a picture of a bat pup. Tape each picture onto a film canister trying to tape each in the same way so students will not be able to tell them apart by - feeling the tape. Tell students they will be pretending to be mother bats and that the canisters represent their babies. The egg carton will be the bat nursery where they will leave their babies when they go hunting for food. Explain that because the cave in which they live is very dark, they will be wearing blindfolds.



Bat Pup

4. Help each child put on a blindfold. Then have students remove the lid from their canisters. Give students a minute to get familiar with their pup's scent. Then, leaving the lids off, ask students to place their pup in the nursery (egg carton). Have students imagine they are going to look for food. Discuss what they might eat and how they might find it.

5. One at a time, ask students to pretend to return to the nursery to find their pup. Once they have found their pup, they should remove it from the nursery and hold it. If a student can't find her pup, ask the student to wait until the others have selected pups and then try again. If the student still isn't sure (it is possible that another student may have taken their pup), encourage her to select one of the remaining pups and be ready to describe how it differs from her's.

6. Have students take off their blindfolds and look at the pups. Discuss how they found their pup *(using their sense of smell and position)* or why they might have found the wrong pup *(they couldn't remember the pup's smell or position, someone had already taken their pup.)* Ask how real mother bats might find their babies in a dark cave or barn with hundreds of pups to choose from. *(In the same way, using their sense of smell and position. Real bats also use their sense of hearing.)*

Right Hear

Key Words: bats, echoes, echolocation, sound, listening

Concept: Some bats use echolocation to find food.

Some bats, unlike Stellaluna, really do prefer to eat insects. These bats hunt for insects at night using their ears rather than their eyes. They do this by making a high-pitched sound and then listening for the sound waves to bounce back off of an insect. Because this is like listening for an echo, it is called echolocation. Bats are so good at echolocation that from it they can determine an insect's size, direction, and distance. In this activity, you can try simulating echolocation.

Materials: Blindfolds, large open area.

1. Practice echoing by clapping a simple musical pattern with your hands and asking students to repeat it after you. Explain that echoes sound like this, but are made by a noise that is bounced or reflected back. Tell students that some insect-eating bats make a sound while flying. When an insect is near by, the sound bounces off the insect, making an echo. The echo helps the bat locate the insect.

2. Tell students that they will be playing a game in which students will pretend to be a bat using echoes to find insects. Select one student to play the part of a bat and two or more students to play insects.

3. Have the remaining students stand in a large circle with the students playing the bat and insects inside. Blindfold the bat.

4. Explain that the bat must try to find an insect using echolocation. The bat claps and the insects must echo back with a clap. After they clap, the bat and insects may each move two steps. The insects may move around in the circle, but not outside it. Remind students in the circle to be quiet so the bat can hear the echoes. Once the bat touches or "catches" one of the insects, the bat and that insect each choose a student from the circle to take their place.

Alternative: Give students percussion instruments, such as castanets, to use instead of clapping.

Dance To The Music

Key Words: bats, energy, sound waves, vibrations, sense of hearing

Concept: Sound waves cause tiny bones inside our ears to vibrate, allowing us to sense sound.

Bats have a very specialized sense of hearing. Although we cannot hear the high-pitched sounds that bats make or the returning echoes, we do hear in much the same way as bats. As sound energy passes through an object, some of the energy is absorbed by the object which causes it to vibrate. It is these tiny vibrations that our ears sense when we hear a sound. Bat ears are so sensitive that they can hear vibrations that our ears can't. We often can't see the vibrations caused by sound waves, but sometimes we can see the motion they cause.

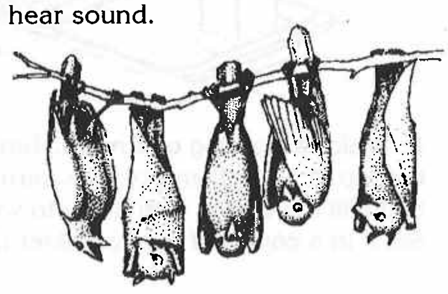
Materials: Small radio that can be laid down so that the radio speaker is horizontal, table or other flat surface, piece of black paper about 3" X 5", tape, salt.

1. Lay the radio down on a table so that the speaker is horizontal and is facing up.

2. Tape the black paper over the radio speaker. Make sure the paper is as flat as possible and as level as possible.

3. Pour about 1/2 teaspoon of salt onto the center of the paper.

4. Turn on the radio and watch what happens to the salt. The salt will seem to start dancing to the beat of the music. As the sound waves move out from the speaker they cause the paper and the salt to vibrate. Try turning the radio volume up and down. What happens to the salt ? *(Increasing the volume, increases the amount of energy so the salt moves more. Decreasing the volume, decreases the amount of energy so the salt moves less.)* Just like the salt and the paper, the sound waves cause tiny bones inside your ears to vibrate. That's how we hear sound.



Wave Good-bye

***Key Words:** bats, energy, waves, echolocation, sound*

***Concept:** Waves, including sound waves, travel out in all directions.*

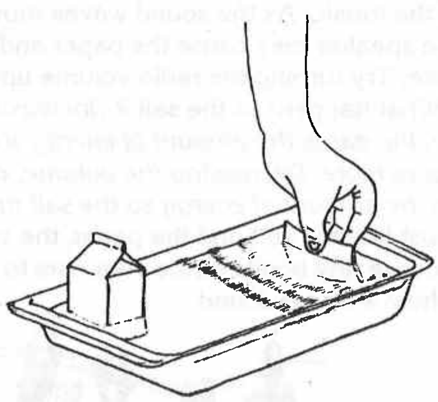
When a bat makes its high-pitched screech, the sound waves from the squeak travel out in all directions. The way the bat knows the location and size of an insect is by the direction and other properties of the returning wave.

Materials: Rectangular clear container at least 8" x 13" such as a sheet cake pan , water, blue food coloring, sheet of aluminum foil (about 12" X 12"), small empty milk carton, drawing paper, crayons.

1. To make a wave tank, cover the bottom of a clear plastic container with about 1/2 " of water that has been dyed with blue food coloring.

2. Fold a sheet of aluminum foil several times until you have a stiff rectangular strip that is about 1-1/2" by 4".

3. Stand the strip in the water at one end of the wave tank so that a long edge of the strip is down. Quickly push the strip along the bottom of the tank for several inches to create a wave in the water. Lift the strip out of the water and watch the movement of the wave. After it reaches the end of the tank, it will bounce back and move in the opposite direction. This is like the returning sound waves that bats use in echolocation. You can try it again, but wait until the water is completely still.



4. Make a drawing of a moth. Tape the drawing to the top of a small empty milk carton. Then partially fill the carton with water to weigh it down. Set it in a corner of the container of water.

5. Starting at the end of the tank opposite the milk carton, use the strip to create a wave as in Step 3. Watch the movement of the wave. Part of the wave will hit the moth (milk carton) and be bounced back earlier than the rest of the wave. The rest of the wave will keep moving until it hits the end of the tank. This creates two returning waves of different sizes and from different locations; one bouncing back off the moth, and the other from the end of the tank.

There And Back Again

Key Words: bats, sound, energy, waves, echolocation

Concept: An echo is a reflected sound wave.

Sound is one kind of energy that travels in waves. If sound waves hit a solid object, some of the energy is absorbed by the object and some of the energy is reflected back. In echolocation, bats are listening for this reflected energy.

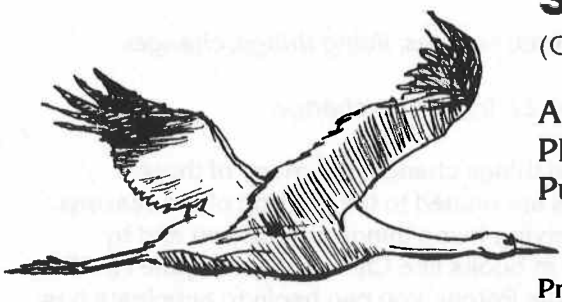
Materials: 20 ft of rope, door with a door knob, drawing paper, crayons, tape.

1. Tie a rope securely to a door knob or other stable object.

2. Make a drawing of a moth. Tape the drawing to the door knob at the end of the rope.

3. Holding the other end of the rope, stand far enough away from the door so that the rope dips down slightly. Hold your end of the rope at about the same level as the door knob.

4. Pretend that you are a bat. Say "squeak" and give the rope a single, quick flip up and down using your wrist. Watch the wave move along the rope to the moth drawing. When the wave reaches the moth (door knob), some of the energy is absorbed into the door knob and some of the energy is reflected back. Watch and you will see a smaller wave bounce back towards you. This is like the returning sound waves that bats hear in echolocation. Wait until the rope is completely still and make another wave. It may take you several trials to create a good wave—not too small, not too big. It may also take a little time for your eye to be able to follow the wave down the rope and back. Keep trying, each time perfecting your technique.



Summer

(GPN # 103)

Author: Ron Hirschi
Photos: Thomas D. Mangelsen
Publisher: Cobblehill/Dutton

Science Focused

Program Description: Each season brings its own collection of changes for plants, animals, and the world around us. In this show we cycle through the seasons with LeVar, sampling some of the sensations special to summer, fall, winter, and spring.

Bundle O' Wonder

Key Words: *seasons, insulation, temperature, heat*

Concept: *Socks and other clothes have no heat of their own, but they slow down the loss of heat from our bodies.*

When winter winds start blowing, LeVar isn't the only one who likes to "bundle up" to stay warm. Most mammals do this by growing a heavier coat of hair in winter than in summer. The extra heavy coat of hair, like LeVar's extra layers of clothing, helps to insulate a mammal by slowing down the transfer of their body heat to the cold winter air.

A heavy winter coat is not like an electric blanket — it doesn't radiate heat. A coat holds in body heat.

Materials: 2 child-safe thermometers, a heavy wool sock, two plastic bowls.

1. Feel the sock. As you touch the sock, notice that it seems to feel neither hot nor cold but about the same temperature as the rest of the room. (There may be some students that think it feels warmer.)

2. Place two bowls on a shelf or table away from a heat source. Put the sock in one of the bowls.

3. Read and record the temperature on the two thermometers. (They should start with the same temperature.) Place one thermometer in the sock in the bowl and the second thermometer in the empty bowl. Predict what will happen to the temperature readings on the thermometers.

4. After about 30 minutes record the temperatures on the thermometers. Do this every 30 minutes or as often as convenient for about 2 hours. What happens? *(Because the sock has no heat of its own, the temperatures on the two thermometers will remain the same i.e. room temperature).*

Follow-up Activity

Materials: 2 child-safe thermometers, a heavy wool sock, two plastic bowls, two warm hard-boiled eggs (An adult will need to hard boil the eggs just before the activity.)

1. Repeat the steps above but this time add two boiled eggs that are still very warm. Remove a small section of the shell on each egg and gently push the bulb end of a thermometer into each egg. Be careful to insert both thermometers about the same distance into the eggs. "Bundle up" one of the eggs in the wool sock and place the other egg in the empty bowl. After predicting what will happen, again read and record the temperatures on the two thermometers about every 30 minutes for two hours. *(This time the temperatures will not stay the same. The egg wrapped in the wool sock will be insulated from the cooler outside air and will stay warm longer than the uninsulated egg.)*

2. Do the activities again placing the bowls in a refrigerator or chest of ice. Can you predict what will happen?

Do Banana Boats Float?

Key Words: *seasons, density, fruit, vegetable, float, air*

Concept: *Some fruits and vegetables are less dense than water.*

Fall is the time of year when cranberries and many other fruits and vegetables are ready for harvesting. In this show the Beaton family explain that because cranberries float, they are harvested by flooding the fields with water. Many other fruits also float. Predict which fruits float and which do not.

Materials: Fresh fruits and vegetables, tub of water, paper, pencils.

1. Draw a line down the middle of a sheet of paper. Label the left side of the line "Floats" and the right side "Sinks."

2. Pick up a piece of fresh fruit or vegetable. Do you think it will sink or float in water? If you think it will float, draw a picture of it on the "Floats" side of the paper. If you think it will sink, draw a picture on the "Sinks" side. If you think it will not sink to the bottom or float to the top, draw a picture of it on the line.

When you do this you are making a prediction about the density of the fruit or vegetable. Density has to do with size and weight. If two things are the same size and one sinks in water and the other floats, then the one that sinks is more dense than water and the one that floats is less dense than water. Fruits and vegetables that do not really sink or float have the same density as water.

3. Put each fruit or vegetable in a tub of water one at a time. What happens? If you guessed wrong, place an X on the picture and draw it again to show what really happened.

Science Note: Cranberries float because they contain small air pockets and air is less dense than water. In addition to air, there are other substances that are less dense than water, such as oil and cork. Most of the fruits and vegetables that float in water do so because they are made of substances that are less dense than water, not because they contain air pockets.

See Some Seasons

Key Words: *seasons, living things, changes*

Concept: *Living things change.*

All living things change and many of those changes are related to the passing of the seasons. By observing living things around you and by looking at books like **Changes** by Marjorie N. Allen and Shelle Rotner, you can begin to anticipate how certain plants and animals will look and behave each season.

Materials: Magazines with pictures of plants and animals that can be cut out, scissors, glue, drawing paper about 8 1/2" X 11", crayons.

1. Draw a line down the middle of a sheet of drawing paper.

2. Look in magazines for a picture of a plant or animal. Cut the picture out and glue it on the left side of your drawing paper. Decide what season (summer, fall, winter, or spring) is being shown by looking for clues in the picture. Write the name of the season below the picture. Tell what clues in the picture helped you to decide.

3. On the right side of your paper, make a drawing showing something your plant or animal might do or how it might look in the next season. Write the name of the next season below your drawing. If you have a difficult time thinking of something to draw try looking at a book about your plant or animal for ideas.

Extensions:

- Have students to make drawings showing their plant or animal during each of the other three seasons.
- Take students on a walk outdoors. After returning to the classroom ask them to make a drawing of a living thing they saw; then have them make a drawing showing that plant or animal next season.

(See ***Nothing To Sweat About*** next page)

Nothing To Sweat About

Key Words: *seasons, temperature, evaporation*

Concept: *Perspiration helps remove heat from our bodies.*

In summer temperatures can rise and rise and rise. If temperatures get too high, our bodies turn on a natural system of "air conditioning"—perspiration. Perspiration works to cool our bodies because as the water evaporates from our skin, it carries some of the heat energy away with it. Drinking lots of water and a breeze all help this system to really work. So, like LeVar, one of the best ways to cool off in the summer is to sit in a shady spot near a fan, drink a glass of lemonade, and let perspiration do the rest.

Materials: Two child-safe thermometers, small piece of cotton cloth, bowl of room temperature water (the water may need to be left standing in the bowl for several hours before the activity to assure that it is room temperature), rubber band, small sheet of stiff cardboard.

1. Immerse a small piece of cotton cloth in a bowl of room temperature water, then remove the cloth and squeeze out the excess water.

2. Read and record the temperatures of both thermometers. (They should start at the same temperature.) Then gently wrap the wet cloth around the bulb of one of the thermometers and use a rubber band to loosely hold the cloth in place, being careful not to break the thermometer.

3. Place both thermometers in a location away from direct sunlight or a heat source, and fan the thermometers with a small piece of cardboard (being careful not to hit them). After about five minutes read and record the temperatures of both thermometers again.

The temperature on the thermometer with the wet cloth will be less than the temperature on the other thermometer. As the water from the cloth evaporates, it carries away some of the heat from the thermometer bulb. The fanning helps speed the rate of evaporation.

Perspiration works in the same way to cool down our bodies. Drinking lots of water, or lemonade, helps keep us from becoming dehydrated as water from our bodies is lost through the evaporation of perspiration.

All In A Day

Key Words: *seasons, length of day*

Concept: *The number of sunlight hours varies with the season.*

A change in temperature is only one clue that the season is changing. Another even more reliable clue is the change in the number of daylight hours.

Materials: Local newspaper listing sunrise and sunset, chart paper, globe, flashlight.

1. Over a period of about a week, have students record the time of sunrise and sunset listed in a local newspaper.

2. Help them calculate the number of additional or fewer minutes each day.

3. Using a globe and a flashlight, show students how the Earth tilts slightly toward the sun during summer in North America and slightly away from the sun during winter in North America. Explain that it is this tilting that causes the difference in the number of hours of sunlight each day.

Follow-up Activity

Materials: Globe, removable stickers, almanac, chart paper, marker.

1. Have students find Florida, Alaska, Arizona, and Vermont on a globe. (If you live in one of these states choose another.) Place a sticker on each state.

2. Using an almanac help students determine the average number of daylight hours in January for a major city in each of the four states. Record this on chart paper.

3. Ask students to try to identify a pattern. Students should be able to indicate that in winter the northern locations have fewer hours of sunlight than the southern locations. Explain that as the Earth tilts away from the sun, the northern locations in the United States receive fewer hours of sunlight than the southern.

4. Again using the almanac, help students determine the average number of daylight hours for the same four cities in August. Record this on the chart and ask students to look for a pattern. Students should indicate that in summer the northern locations have more hours of sunlight than the southern locations Explain that as the Earth tilts toward the sun in summer, the northern locations in the United States receive more hours of sunlight than the southern.

5. Using the information listed on the chart, ask students to predict the average number of hours of sunlight for a major city in your state in January and August. Use the almanac to check their predictions.

Sunken Treasure

(GPN # 70)

Author: Gail Gibbons
Publisher: Harper Collins

Science Comes Alive

Science Focused

Program Description: What could be left of a ship that sank in 1622? Video footage shows many treasures and artifacts found by divers who located the Atocha, the ship which is the subject of this show's feature book. To explore the subject of sunken treasure further, Dr. Robert Ballard, who located and explored the Titanic—the most famous shipwreck in history—shares the technology he used in his search.

All That Glitters

***Key Words:** gold, tarnish, rust, corrosion, chemical reaction, metal*

***Concept:** Gold does not tarnish or rust because it does not undergo chemical reactions as easily as many other metals.*

Throughout history gold has been highly valued. Its value is enhanced by the fact that it stays shiny when other metals rust or tarnish. Rust and tarnish are caused by corrosive chemical reactions which can ruin metals. Because salt water promotes corrosion, non-gold sunken treasures are at risk. See how salt water affects metals.

Materials: Cups, tablespoons, salt, water, bowls, sets of shiny coins, paper towels.

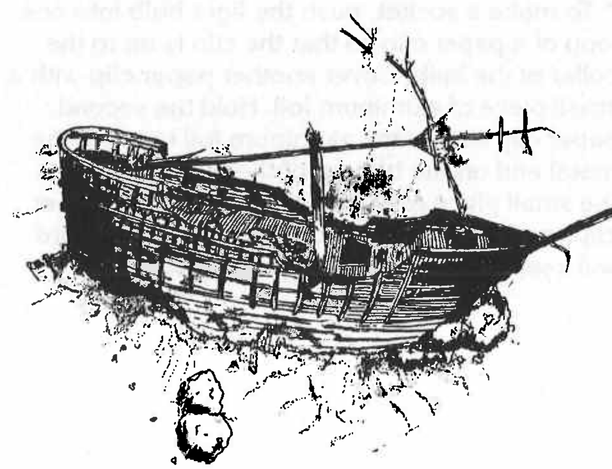
1. Arrange one set of shiny coins (include a quarter, dime, nickel and penny) on a paper towel in a bowl. Repeat this in the other bowl.

2. Mix two tablespoons of salt in a cup of water. Pour enough of this salt water into one bowl to soak the paper towel and surround the coins, but not to cover them. Soak a second paper towel with salt water and place it over the coins.

3. Repeat Step 2 using unsalted water with the other set of coins.

4. In a day or two, the coins covered with salt water will have corroded while the ones in unsalted water will still have a shine.

Science Note: Corrosion happened quickly in this activity because the paper towels kept the coins damp but also allowed oxygen to reach them. Oxygen, which is necessary for corrosion, is less available in the deep ocean, so corrosion takes longer. Over many years, sunken treasure made of most metals will corrode, but those made of gold never will.



Metal Detectives

Key Words: *properties, iron, magnetic, metal, conduct, electricity*

Concept: *Metals can be detected by their ability to conduct electricity.*

Metal detectors work by making use of the special properties of metal. Some metals, especially those that contain iron, are magnetic. Metals also conduct electricity. Build this simple metal detector and test these properties.

Materials: Battery, three wires, flashlight bulb, tape, socket (or two paper clips, aluminum foil, and a small piece of cardboard), clay or sand, a variety of small metal and nonmetal objects: e.g., coins, marbles, acorns, plastic and metal bottle caps.

1. Build a simple circuit using wires, socket* and bulb. Tape an end of one wire to the top of the battery and an end of a second wire to the bottom. Connect the end of one of these wires to one side of the socket and connect an end of the third wire (the one not yet used) to the other side of the socket. When the two remaining loose wire ends touch, the bulb will light.

2. To use this circuit as a metal detector, begin by covering several small metal and nonmetal objects with clay or sand so that they cannot be identified. After reviewing how the bulb lights when the wires touch, show students that the bulb will also light when both wires touch the same metal object. This will not happen when the wires connect with most nonmetals. Have students take turns testing the metal detector on the hidden objects.

* To make a socket, push the light bulb into one loop of a paper clip so that the clip is up to the collar of the bulb. Cover another paper clip with a small piece of aluminum foil. Hold the second paper clip so that the aluminum foil touches the metal end on the bottom of the bulb. Sandwich the small piece of cardboard between the paper clips and tape all three together. The cardboard will keep the paper clips from touching.

Breaking the Surface

Key Words: *buoyant force, lift, heavy, submerge*

Concept: *Water exerts a buoyant force on a submerged object.*

Lifting sunken treasure above the surface of the water is a challenge. Because water exerts a buoyant force, an object will feel lighter in the water than in the air. Therefore a diver who is able to lift a heavy object to the surface, may not be able to lift it out of the water. This buoyant force can be experienced without going diving.

Materials: Small heavy objects (e.g., coins, washers or marbles), plastic netting or pieces of nylon from a stocking, paper clips, thin rubber bands, tub of salt water (2 tablespoons of salt to each quart of water), rulers.

1. Cut a thin rubber band so it's a single strand and tie a paper clip (bent open in the shape of a hook) to it.

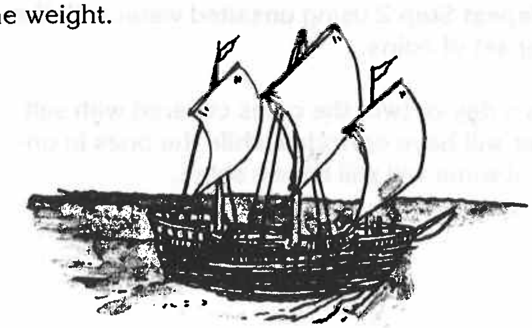
2. Have each group of students wrap several heavy objects in netting or nylon. Attach the net to the paper clip hook.

3. Have students in each group suspend the heavy objects in a tub of water and measure the length of the rubber band.

4. Then have them lift the objects out of the water and measure the length of the rubber band.

5. Discuss how the buoyant force impacts on lifting heavy treasures out of the ocean.

The rubber band is shorter when the object is submerged because water pushes up on the object (this is the buoyant force) and the object feels lighter. The rubber band is stretched longer by the same object when it is out of the water because there is no buoyant force to counteract the weight.



Grid Work

Key Words: *grid, document, reconstruct*

Concept: *Carefully documenting a site allows others to understand how objects were arranged.*

Before the objects in the Atocha were moved, the site was marked off by a grid and each section was carefully documented—illustrated, photographed and labelled—so the records could be used to reconstruct the site. Try this technique of using a grid and creating a numbering system for reconstructing a drawing.

Materials: Grid paper, pencils, crayons, scissors.

1. Give each student a sheet of 2 cm (or 1 inch) grid paper to create a drawing of a sunken ship or underwater landscape which will be coded and then cut apart for reconstruction.

2. When the drawings are finished, students can create a numbering system to code each square of their pictures. Then have them cut their pictures into the individually coded 2 cm. squares.

3. Students can trade their sets of squares with other students who then have the challenge of reconstructing the drawings by using the numbering systems. After giving students a chance to decode the numbering systems and reconstruct the pictures, they can discuss how they numbered their drawings.

4. As a class, discuss the importance of having a coding system that is understandable, especially when it is used for record keeping, so others can understand and use it.

Giving Treasure a Lift

Key Words: *equipment, device, design*

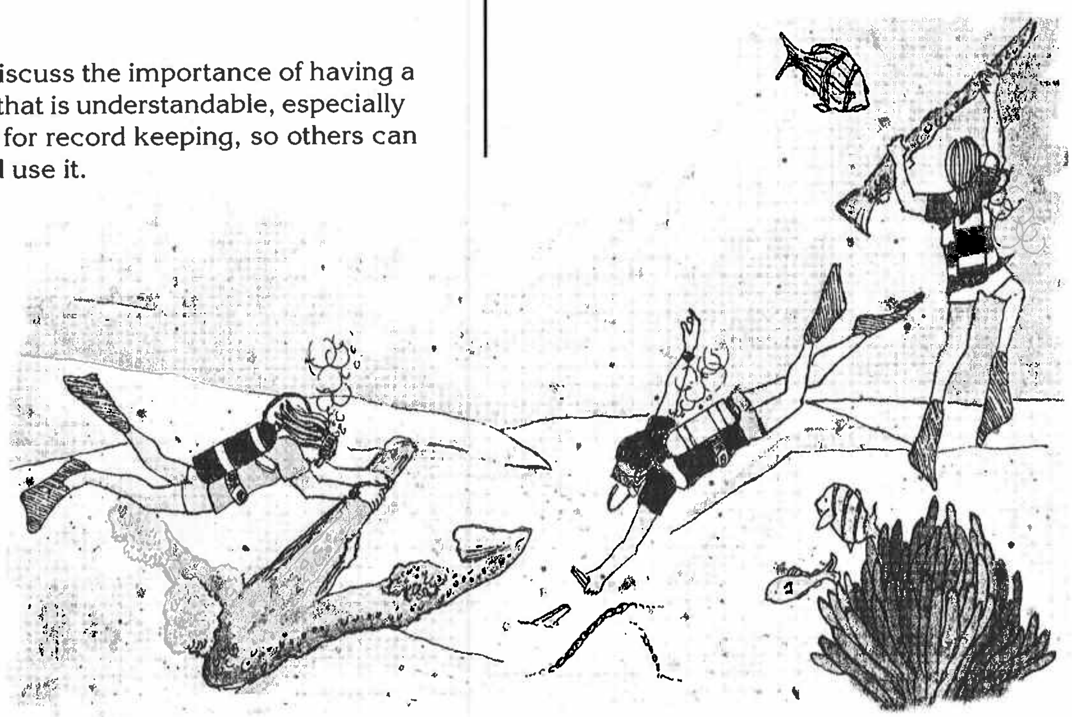
Concept: *Devices can be designed to help us do work.*

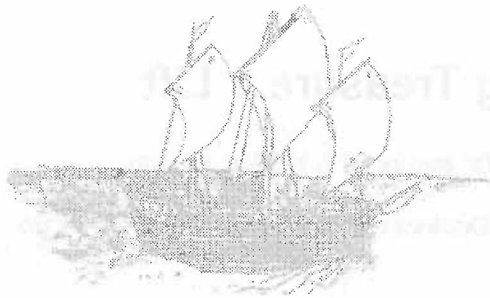
Modern diving equipment makes it possible to raise most shipwrecked treasure. Still, some ships have sunk in water too deep for divers—so devices have been created to retrieve the treasure. Design a treasure-raising device.

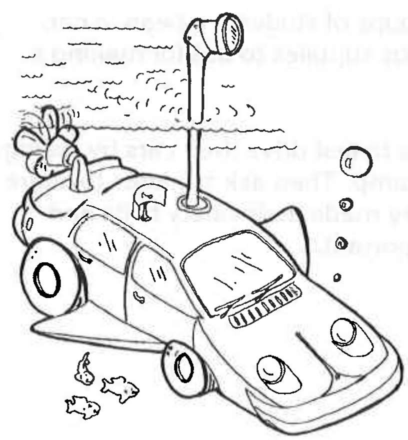
Materials: Large tub or bucket, water, several objects that sink, a variety of materials to create lifting devices: e.g., cups, paper clips, string, fishing line, corks, plastic.

1. Put several non-floating objects into a tub of water and challenge students to use available materials to design devices for lifting objects ("treasure") from the bottom of the tub.

2. Students can work alone, in pairs, or in small groups to construct and test their designs. They may need to adapt their original designs to make them work successfully.







Tooth-Gnasher Superflash

(GPN # 63)

Author: Daniel Pinkwater
Publisher: Antheneum

Science Comes Alive
Science Connected

Program Description: LeVar learns all the ins and outs of automobiles as he spends the day in a service station—and is inspired to find out about solar powered vehicles that compete in the World Solar Challenge, and to see how a car factory assembly line works.

Power Of The Sun

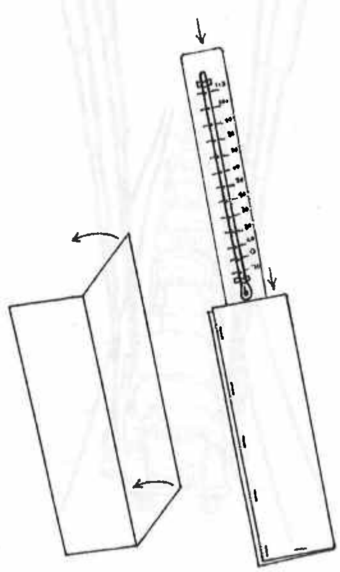
Key Words: *sunlight, energy, reflection, energy conservation*

Concept: Sunlight is a source of energy.

Most cars today are powered by gasoline, but cars of the future, like those seen in this episode, may be powered by energy from the sun. All these cars need is a sunny day and they are off and running.

Materials: Black construction paper, aluminum foil, 2 child-safe thermometers, stapler, direct sunlight or 100-watt lamp, paper, pencil, stapler, tape.

1. Make a pocket out of black construction paper that is large enough to hold a thermometer. Staple the sides of the pocket. Next, make a similar pocket out of aluminum foil.



2. Record the starting temperatures on the thermometers. (The thermometers should be at the same temperature in the beginning.) Place a thermometer in each pocket.

3. Tape the pockets down on a flat surface in direct sunlight or under a lamp. Be sure to put them in a place where they won't be disturbed. Predict what will happen to the temperatures on each thermometer after several minutes.

4. After about 10 minutes, read and record the temperature on each thermometer. (The temperature on the thermometer in the black paper pocket will be higher than the one in the foil pocket.) Feel the surface of each pocket with your hand. The black paper pocket will feel warmer. The black paper absorbs a lot of light energy from the sun. When this happens the light energy changes to heat energy and causes the temperature on that thermometer to rise. The foil paper reflects most of the light energy and the temperature on its thermometer remains lower. This shows that energy from the sun can be changed into other forms of energy (in this case, heat). The solar cars seen in this episode were designed with solar cells that, like the black paper, absorb light energy which is converted to electricity and used to power the cars.

Buckle-up Bean

Key Words: cars, safety, inertia

Concept: Safety belts protect people from continuing to move forward when a car stops suddenly.

No matter what kind of car you dream about, safety is always an important feature of design. Cars often move fast, carrying people with them. When the car stops suddenly, a person in the car tends to keep moving, possibly hitting something and becoming hurt. This tendency for people and other things in motion to keep moving forward is called inertia. Seat belts are an inertia antidote. They help keep people from getting hurt when a fast moving car stops suddenly.

Materials: Sturdy toy cars large enough for a lima bean to fit easily into the driver seat (usually at least 2" x 4"), dry lima beans, permanent marking pen, tape, cardboard, hard cover books, miscellaneous supplies possibly including string, pipe cleaners, index cards, rubber bands, tape.

1. Use a permanent marking pen to draw faces on uncooked, dry lima beans.

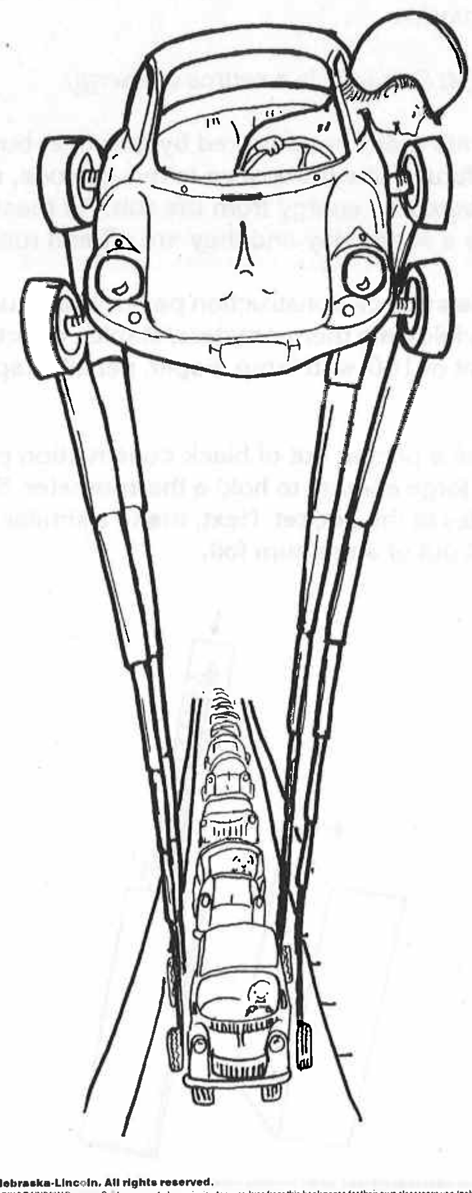
2. Make a stack of books about 6" inches high. Then make a car ramp by taping one end of a piece of heavy cardboard to the top edge of the books and the opposite end down on the floor. Make a crash wall by placing a 2" stack of books about 18" from the bottom edge of the cardboard ramp.

3. Place a car on the top of the ramp with a lima bean sitting in the drivers seat. Allow the car to roll down the ramp and into the crash wall. Explain to students that as the car rolled down the ramp, both the car and the bean gained speed. When the car hit the wall, the car stopped (or changed direction), but the lima bean continued forward.

Have students design a safety belt that will hold a lima bean in a car, and keep the bean from moving when the car stops. The belts must be designed to be put on and taken off easily several times.

4. Give small groups of students a bean, a car, and miscellaneous supplies to use for making a safety belt.

5. Allow students to test drive their cars by rolling them down the ramp. Then ask students to share ideas on how they made their safety belts and why they are important.



Ty's One-Man Band

(GPN # 15)

Author: Mildred Pitts Walter
Illustrator: Margot Tomes
Publisher: Simon & Schuster

Program Description: LeVar explores the sounds of different kinds of music—rap, doo-wa, jazz, and salsa. Then an a capella group, Ben Vereen and Reading Rainbow's music director, Steve Horelick, share their talents and love of music.

Music Box

Key Words: sound, vibrations, pitch

Concept: The characteristics of a sound can be changed.

Andro in the feature book, Ty's One-man Band, was able to create music that made people want to get up and dance, and all he used were some everyday objects. In addition to the items Andro used—spoons, pail, and washboard—try these.

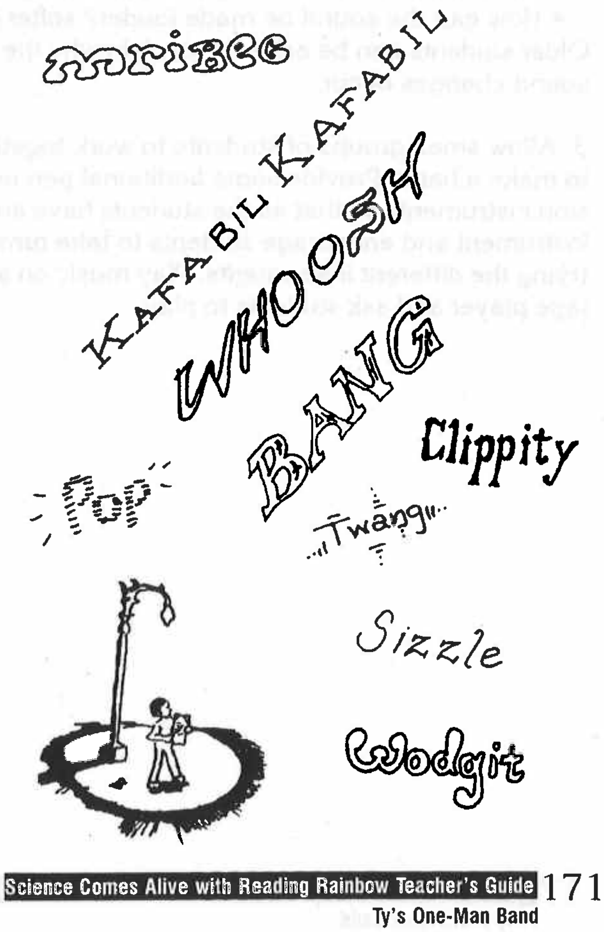
Materials: Small cardboard box such as a child's shoe box, rubber bands.

1. Have pairs of students stretch a rubber band around a small box with high sides.

2. Ask them to gently strum the rubber band. Then squeeze in the sides of the box and strum the rubber band again. The sound changes. Have students try to make up a simple tune, by strumming the rubber band while squeezing and then releasing the sides of the box.

The sounds students hear are produced by the vibrating rubber bands, which causes the air around them to vibrate. When they squeeze the box, they change the amount of tension on the rubber band. Less tension causes the rubber bands to vibrate slower and produce a lower pitched sound. The tighter rubber bands vibrate faster and produce a higher pitch.

This activity can be extended by having students try using other rubber bands. They will find that the different rubber bands have a variety of sounds. Can they guess why? (*Shorter, thin rubber bands will vibrate more quickly and make a higher pitched sound. Longer, thicker rubber bands will vibrate more slowly and make a lower pitched sound.*) Ask students to make a box with all high pitched strings and another box with all low pitched strings.



It's Music To My Ears

Key Words: sound, vibrations, pitch

***Concept:** Sound is caused by vibrations.*

Almost anything can be used to make music—the item just has to make a sound and anything you can cause to vibrate will make a sound.

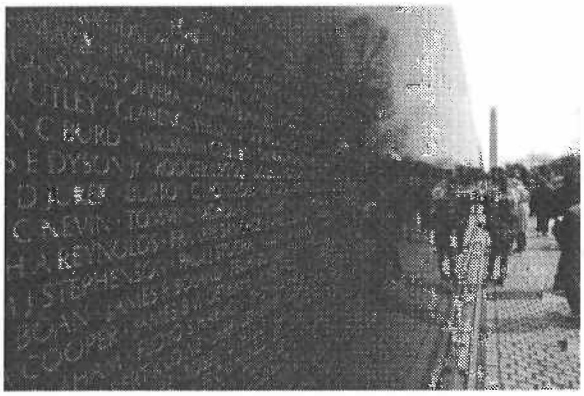
Materials: Common items that can be used to make instruments (e.g. boxes, plastic containers, string, rubber bands, paper cups, metal cans, milk carton, straws, spoons, ice cream sticks, paper clips, bottles), tape player, tape of music.

1. Ask pairs of students to make a unique instrument using common items from school and home. Tell them that their instrument must be able to make a sound that can be changed from a high to a low pitch. You can use the rubber band instrument in the previous activity as an example.

2. Have students present their instruments to a small group of students. Their presentation should demonstrate the following:
   - What part of the instrument vibrates to make a sound?
   - How can the sound be made higher? lower?
   - How can the sound be made louder? softer?

Older students can be asked to explain why the sound changes occur.

3. Allow small groups of students to work together to make a band. Provide some additional percussion instruments so that all the students have an instrument and encourage students to take turns trying the different instruments. Play music on a tape player and ask students to play.



The Wall

(GPN # 82)

Author: Eve Bunting
Illustrator: Ronald Himler
Publisher: Clarion Books

Science Connected

Program Description: LeVar visits the Vietnam Veterans Memorial to find out about monuments. Maya Lin, the young architect who designed the Memorial, describes her vision and the process of creating this special place. Other monuments explored include Mount Rushmore—the sculpture of four leading presidents, and a mural dedicated to Louis Armstrong—a great jazz trumpeter.

A Monumental Idea

Key Words: rocks, hardness

Concept: A soft kind of rock is easy to carve.

When architects begin planning a monument, they must give careful consideration to the type of rock that will be used. One important quality of rocks and minerals is their hardness. A soft kind of rock can be carved easily, but may not last very long outside. A hard kind of rock may be difficult to carve, but will last a long time. Rocks and minerals are often classified by their hardness in numbers from 1 to 10, with 10 being the hardest. A diamond has a hardness of 10 and chalk has a hardness of 2. One of the reason Maya Lin, the architect who designed the Vietnam Veterans Memorial, chose black granite, is that granite is a very hard rock. Carve a monument from a rock that is fairly soft, gypsum.

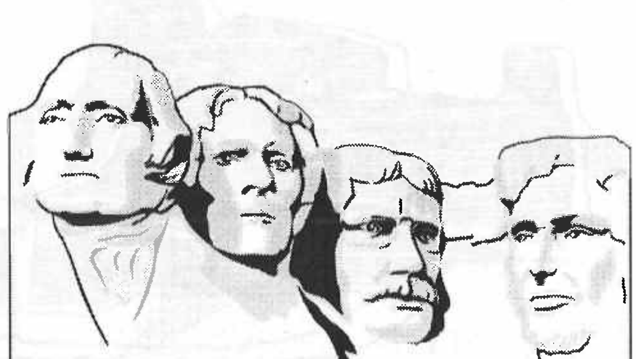
Materials: Plaster of Paris, water, spoon, bowl, measuring cup, small milk carton, pencil, tools for carving such as a table knife and spoon.

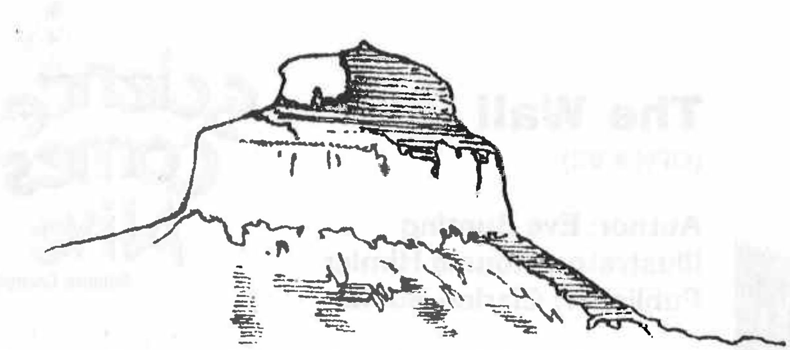
1. When the mineral gypsum is heated, it loses most of its water and changes into the fine white powder called plaster of Paris. When you add water to the powder it turns back into a block of gypsum. Pour 1 cup of plaster of Paris into a mixing bowl and add 1/2 cup of water. Stir the mixture until it becomes smooth.

2. Pour the mixture into a small milk carton and wait a day until it hardens. Then tear the milk carton away from the gypsum block inside.

3. To test for the hardness of gypsum, try to scratch it with your fingernail. Your fingernail has a hardness of about 2.5. If you can scratch gypsum with your finger nail, then it has a hardness less than 2.5. (Gypsum has a hardness of 2.)

4. Think of a simple shape to carve out of the gypsum block and then use a pencil to draw an outline of the shape on the block. You can carve what you imagine to be a different view of the shape on each side. You can use tools such as a table knife and spoon to carve your monument. What will your monument remind you of?





Weathering, The Test Of Time

Key Words: rocks, weathering, leaching

Concept: Rocks can be worn down over time by water.

Monuments are intended to "stand the test of time," but what does that really mean? Monuments that stand out in the open have to endure the wind, rain, snow, heat, and other elements of the weather. Even a very hard rock gets worn down over time by these elements in a process that is called *weathering*. Water—in the form of rain, snow, sleet, and even fog—is particularly good at weathering rocks. Some weathering is done as water dissolves minerals in rock and carries them away. This is called leaching.

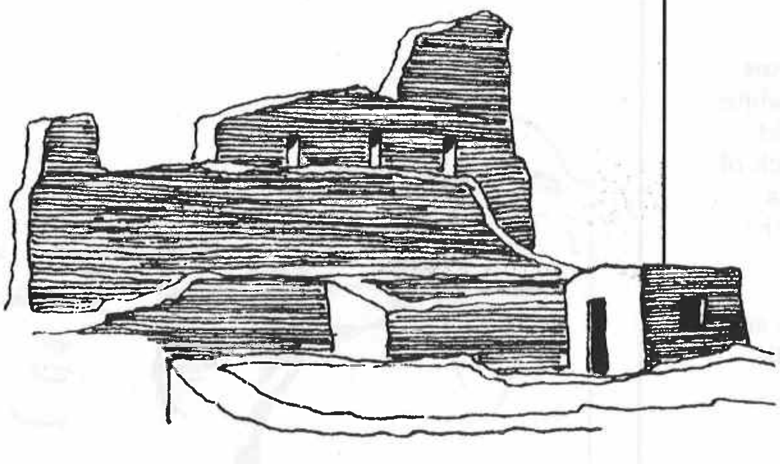
Materials: Instant coffee, regular coffee grounds, warm water, clear cups, spoons.

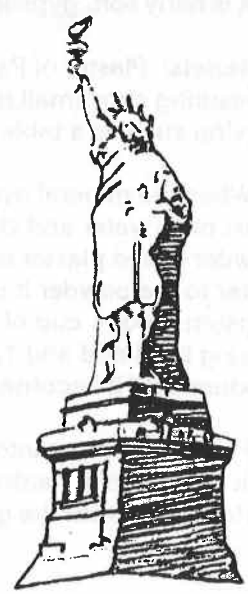
1. Fill two cups each about half full of warm water.

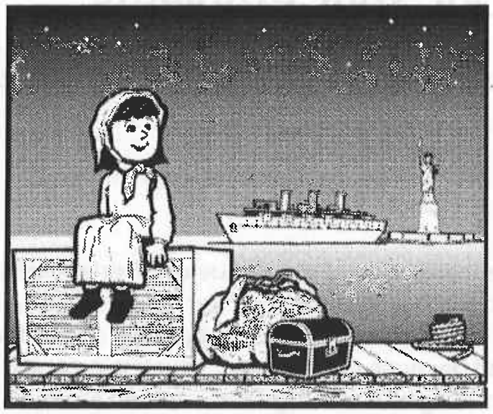
2. Put about a 1/2 teaspoon of instant coffee in one cup and about the same amount of coffee grounds in the other.

3. Stir each cup for a minute or two and watch what happens to the added coffee and to the water in each. The water will darken in both cups. However, the instant coffee will eventually dissolve (and disappear) in one cup, while the coffee grounds in the other will not dissolve and will remain visible. (You can try to stir the cup with the coffee grounds some more, but the grounds will not dissolve.)

Explain that each cup shows a different example of weathering. The instant coffee is an example of a substance that can be dissolved by water. The coffee grounds are an example of leaching. There is something dissolving out of the grounds that is changing the color of the water, but other parts of the grounds are not dissolving and remain solid. Water can weather rocks in the same ways. Some rocks can be dissolved over time by water. In other rocks, only certain parts of the rock are leached out by water. When this happens the rock is weakened and will then crack or crumble more easily.







Watch The Stars Come Out

(GPN # 29)

Science Connected

Author: Riki Levinson
Illustrator: Diane Goode
Publisher: Dutton

Program Description: Visiting Ellis Island, the port of entry for millions of immigrants who came to America with hopes and dreams for a better life, is a trip back into the past. LeVar explores the purpose of the island and then visits the Statue of Liberty where he climbs to the top to see how this important symbol is being re

A Penny Of A Different Color

Key Words: *metals, copper, chemical reactions, color change.*

Concept: *One sign of a chemical reaction is a color change.*

When the Statue of Liberty first arrived from France in 1886, it was a deep brown copper color. Those looking at the Copper Lady today will note that it is no longer brown, but light green. The green coating is a layer called patina that has formed as the copper reacted with gases in the air.

Materials: Pennies, white paper towels, vinegar, small plastic plates, small cups.

1. Discuss how the Statue of Liberty and a penny are both covered with a metal called copper. (*Pennies are made from zinc and coated with a layer of copper.*) The color of the Statue was once the same as a penny, but that has been changed by chemical reactions. Students can experiment with pennies to see this change.

2. Have small groups of students fold a paper towel in half twice and place it on a small plate.

3. Give each group a small cup containing about two tablespoons of vinegar. (They will need enough vinegar to soak the towel but not flood the plate.) Ask them to pour the vinegar on the paper towel.

4. Have them place several pennies on the vinegar soaked paper towel, press them down against the towel, and then turn them over. Have them place several pennies on a separate paper towel and plate with no vinegar—this will be their control group. Leave the pennies overnight.

5. The next day, have them look at the pennies and compare the color of the control group to the pennies on the paper towel soaked with vinegar. How have the pennies changed? (*The pennies exposed to the vinegar will have turned green, especially around the edges.*) What caused the change? (*A chemical reaction has taken place. The copper has reacted with the vinegar to form a green compound—the copper and vinegar reacted to form copper acetate. The green on the Statue of Liberty is copper sulfate.*)

Pretty As A Penny

Key Words: metals, copper, chemical reactions.

***Concept:** Copper metal can be changed by a chemical reaction.*

In the case of the Statue of Liberty, the formation of the green layer of copper sulfate has helped preserve it. Because the copper sulfate is less reactive to gases in the air than copper is, this patina works as a protective layer over the copper which is still below it. When shiny copper metal on new pennies or the young Statue of Liberty is exposed to air, it slowly changes to a dark brown or black, and a patina layer forms in time. The dark brown or black tarnish is copper oxide which can easily be removed.

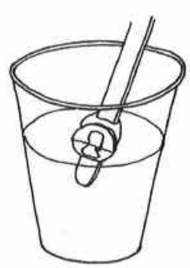
Materials: Vinegar, small plastic bowl, salt, spoon, old pennies, water, craft stick (optional), oil-based modeling clay (optional).

1. Pour about one-half cup of vinegar into a small plastic bowl.

2. Add one teaspoon of salt to the vinegar and stir until all the salt is dissolved.

3. Place an old brown penny into the vinegar and stir gently with a spoon for just a minute or two. (You can also use this solution to clean the pennies from the ***A Penny Of A Different Color*** activity.)

4. Remove the penny and rinse it with water. Notice the change in the appearance. (*The copper oxide tarnish is removed as it reacts with the acid in the vinegar. This chemical reaction actually removes a thin layer from the penny leaving shiny copper exposed. If enough copper is removed from the surface of a penny in this way, the gray zinc metal underneath the copper will become visible.*)



Extension: Attach a penny to the end of a craft stick using oil-based clay. Hold the craft stick so the penny is only halfway in the vinegar. Do this for about a minute, then remove the penny and rinse with water. The portion of the penny that was in the vinegar will be much brighter than the other half.

Iron Out Your Problems

Key Words: metals, iron, chemical reactions, rust, corrosion.

***Concept:** Iron can be changed by a chemical reaction.*

During the restoration of the Statue of Liberty it was discovered that some of the iron framework inside the statue that supports the copper panels needed to be replaced because of corrosion, which is a combination of rusting and etching. The iron had slowly reacted with oxygen in the air to form iron oxide, or rust. Some of the metal was also chemically etched away by moisture. This corrosion made the iron bars weak and brittle. They replaced all two thousand iron bars with stainless steel ones, which should give the statue strong, rust-free support for the next one thousand years.

Materials: Steel wool (without soap), water, vinegar, white paper towels, plastic bowls, craft sticks.

1. To see how steel wool can be corroded, pour about 1/2 cup of vinegar into one bowl, and about 1/2 cup of water into another. Divide a pad of steel wool into three fairly equal balls.

2. Place one ball of steel wool in the bowl of vinegar, another in the bowl of water, and leave one dry. Roll the balls around in the liquid, and then allow them to soak for several minutes.

3. Remove the steel wool using a clean spoon for each one, and place each ball on a labeled paper towel. After about 24 hours, examine the balls. Are there signs of brown rust? Which ball has the most? (*The ball soaked in vinegar.*) Which has the least? (*The ball left dry.*)

4. Use craft sticks to pull the steel wool balls apart. Notice how easily the corroded steel wool crumbles. Discuss the importance of replacing the iron framework in the Statue of Liberty. (*The Statue of Liberty had an additional problem. Wherever the iron and copper metals touched, the corrosion of both metals was speeded up. Alexandre Gustave Eiffel, the man who later built the Eiffel Tower, designed the framework inside the statue. He tried to keep the reaction between the two metals from happening by placing padding between them, but over the years the padding decayed allowing the copper and iron to touch in many places.*)

Resources

Resources: Organizations

AIMS Education Foundation
http://wwwaimsedu.org/
(activities integrating math and science)
1595 S. Chestnut Ave, Fresno, CA 93702
Toll-free: 1-888-SEE-AIMS

American Association for the Advancement of Science Project 2061
http://www.project2061.org/
(information to support reform-based science education)
http://ehrweb.aaas.org/ehr/
(current issue of Science Education News)
1333 H Street, NW, Washington, DC 20005
Telephone: (202) 326-6666

American Chemical Society
http://www.acs.org/wondernet/
(Wonder Science activities guides and other programs)
1155 16th Street NW, Washington DC 20036
(202) 872-4600 or (800) 227-5558

American Forest Council
http://www.affoundation.org
(Project Learning Tree — environmental awareness activities)
1111 19th Street NW, Suite 780
Washington, DC 20036

American Geological Institute
http://www.agiweb.org/
(earth science materials and publications)
4220 King Street, Alexandria, VA 22302-1502
http://www.earthscienceworld.org/
(Earth Science World)

Eisenhower Mathematics and Science Consortia
http://www.enc.org/
(resources and updates about science and mathematics education)
(800) 362-4448
ERIC Clearinghouse In Elementary and Early Childhood Education
http://ericeece.org/
(citations and links to many publications of interest to educators)
Helping Your Child Learn Science by the US Department of Education, Office of Educational Research and Improvement Publication
http://www.ed.gov/pubs/parents/Science/index.html

Exploratorium
http://www.exploratorium.edu/
(activities for inquiry-based science from a national leader among science museums,)
3601 Lyon Street, San Francisco, CA 94123
(415) EXP-LORE

Explorit Science Center
http://www.explorit.org/
(on-line resources for teachers and students)
P.O. Box 1288, Davis, CA 95617
(530) 756-0191

GEMS: Great Explorations in Math and Science
http://www.lhs.berkeley.edu/GEMS/GEMS.html
(thematic science and math activities)
Lawrence Hall of Science #5200
University of California, Berkeley, CA 94720
(510) 642-7771

National Academy Press
http://www.nap.edu/index.html
(science-related publications and educational resources from major government agencies)

National Arbor Day Foundation
http://www.arborday.org/
(tree planting initiatives)
100 Arbor Avenue, Nebraska City, NE 68410

National Gardening Association
http://www.kidsgardening.com/
(support materials for gardening with children)
1100 Dorset Street, South Burlington, VT 05403
(877) 538-7476

National Geographic Society
http://www.nationalgeographic.com/
(publications and online support for teachers)
P.O. Box 98199, Washington, D.C. 20090-8199
(800) 647-5463

National Science Foundation
Office of Legislative and Public Affairs
http://www.nsf.gov/od/lpa/events/start.htm
(various programs and resources)
(703) 292-8070

National Science Resources Center
(operated in cooperation with the Smithsonian Institution to improve science education)
955 L'Enfant Plaza, SW, Suite 8400
Washington, DC 20560-0952
(202) 287-2063

Resources: Organizations (cont.)

National Science Teachers Association
http://www.nsta.org/
(professional resources and contacts)
1840 Wilson Boulevard, Arlington VA 22201-3000
(703) 243-7100

National Wildlife Federation
http://www.nwf.org
(National Wildlife Week & Naturescope — environmental awareness activities)
8925 Leesburg Pike, Vienna, VA 22184

NASA CORE
http://core.nasa.gov
(space program information and projects)
Loraine County Joint Vocational School
15181 Route 58 South, Oberlin, OH 44074

NOVA Online
http://www.pbs.org/wgbh/nova/
(Resources to accompany the PBS series)

Project Learning Tree
http://www.affoundation.org
http://www.plt.org/
1111 19th St. NW, Suite 780
Washington, DC 20036
1-888-889-4466

Project WILD
http://eelink.umich.edu/wild/
(activities and training in environmental awareness)
5430 Grosvenor Lane, Bethesda, MD 20814

Science Learning Network
http://www.sln.org/index.html
(information and resources to support inquiry-based science education)

Science Service
http://www.sciserv.org/abtssvc.asp
(programs and information to promote an appreciation of science)
http://www.sciencenews.org/index.asp
(ScienceNews)
1719 N Street, NW, Washington, DC 20036
(202) 785-2255

U.S. Department of Health and Human Services
http://www.girlpower.gov/default.asp
(programs for youth health and education-such as GirlPower)
(800) 729-6686

Water Environment Federation
http://www.wef.org/
(information and resources about water issues including The Water Sourcebook)
601 Wythe Street, Alexandria, VA 22314-1994
(800) 666-0206

(See *Resources: Books* next page)

Resources: Books

Archer, Cheryl. **Snow Watch**
(Kids Can Press) 1997.

Bittinger, Gayle & Marion Ekberg. **1-2-3 Science : Science Activities for Working With Young Children.**
(Warren) 1993

Bosak, Susan V. **Science Is...A Source Book of Fascinating Facts, Projects and Activities**
(Firefly Books) 2000.

Cash, Terry; Steve Parker & Barbara Taylor. **175 More Science Experiments to Amuse and Amaze Your Friends.**
(Random House) 1991

Churchill, E. Richard. **Instant Paper Toys to Pop, Spin, Whirl and Fly.**
(Sterling) 1987.

Cobb, Vicki & Kathy Darling. **Bet You Can.**
(Avon Books) 1989.

Cobb, Vicki & Kathy Darling. **Bet You Can't.**
(Avon Books) 1983.

DeBruin, J. **Creative Hands-on Science Experiments.**
(Good Apple) 1986.

Gardner, Robert. **Make an Interactive Science Museum.**
(*McGraw-Hill*) 1995.

Herbert, Don. **Experiments for Young Scientists.**
(Doubleday) 1990.

Hirschfeld, Robert & Nancy White. **The Kids' Science Book : Creative Experiences for Hands-On Fun.**
(*Williamson Publishing*) 1995.

Huelbig, Carole & Janet W. Roberts. **City Kids & City Critters! : Activities for Urban Explorers from the Houston Arboretum & Nature Center.**
(McGraw-Hill Professional Publishing) 1996.

Kneidel, Sally Stenhouse. **Creepy Crawlies and the Scientific Method: More Than 100 Hands-On Science Experiments for Children.**
(Fulcrum) 1993.

Liem, Tik L. **Invitations To Science Inquiry.**
(Science Inquiry Enterprises) 1990.

Ontario Science Centre. **Scienceworks.**
(Perseus Press) 1986.

Pearce, Charles R. **Nurturing Inquiry: Real Science for the Elementary Classroom.**
(*Heinemann*) 1999.

Ticotsky, Alan. **Who Says You Can't Teach Science.** *(Goodyear Publishing) 1999.*

VanCleave, Janice Pratt. **Janice VanCleave's Microscopes and Magnifying Lenses: Mind-boggling Chemistry and Biology Experiments You Can Turn Into Science Fair Projects.**
(John Wiley & Sons) 1993

Wood, Robert W. **The McGraw-Hill Big Book of Science Activities: Fun and Easy Experiments for Kids (Science for Kids Series)**
(McGraw-Hill) 1999

(See *Resources: Publications* next page)

Resources: Publications

Odyssey (ages 8-14)
Click
Cobblestone Publishing
7 School Street, Peterborough, NH 03458
(800) 821-0115

Science Weekly (grades K-6)
2141 Industrial Pkwy, #202
Silver Spring, MD 20094
(301) 680-8804

Ranger Rick (ages 6-12)
Your Big Backyard (ages 3-5)
National Wildlife Federation
PO Box 777, Mount Morris, IL 61054
(800) 822-9919

National Geographic World (ages 8-12)
Magazine Orders
PO Box 60032, Tampa, FL 33663-3002
(800) 647-5463

The National Geographic Society
(educational services catalog)
1145 17th Street NW
Washington, DC 20036-4688
(800) 638-4077

Explore
PO Box 37590, Boone, IA 50037-0590
(877) 817-4395

YES mag
3968 Long Gun Place, Victoria, BC
V8N 3A9 Canada

Dolphin Log
Cousteau Society Inc
870 Greenbriar Circle, Suite 402
Chesapeake, VA 23320
(804) 523-9335

For a complete list of children's science magazines
http://www.salusda.gov/ttic/kids/scimags.htm

Reading Rainbow episodes on VHS, teacher guides, related books and other resource materials can be found at *http://gpn.unl.edu/rainbow or* call GPN at 1-800-228-4630 for a catalog.

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